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Occurrence and Recovery of the Virus of Infantile Paralysis from Sewage*

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THE discovery that the virus of poliomyelitis could be found in human feces was made in Sweden about thirty years ago,[1] and corroborated in the United States a few years later,[2] but interest in these findings soon waned because for a long time no one repeated the discovery. About four years ago, however, this fact, namely the presence of virus in human stools, was "rediscovered," and it soon became evident that in young patients recently convalescent from poliomyelitis it is easier (perhaps much easier) to demonstrate the virus in the stool than in the nose or throat. One reason for this is, that after an attack of the acute disease the virus remains in the intestinal tract for longer periods of time than in the throat. In stools it has been repeatedly found, in the second or third week of convalescence from a severe or mild attack of the disease.[3] In one series of cases it was demonstrated in almost 70 per cent of the cases tested.[4] Occasionally the virus may persist in the stools for months, as was noted in a report from Paris where the virus was isolated from the stool of a child who had sustained a mild attack of the disease 123 days prior to the time when the test was made.[5]

These findings tend, whether rightly or wrongly, to place poliomyelitis in the category of so-called intestinal diseases, which include typhoid fever and dysentery. We are not on the firmest of ground in classifying poliomyelitis this way, for we do not know whether the presence of the virus in the stools of patients is a direct or even an indirect link in the chain which actually leads this agent from one patient to another. But from the epidemiological standpoint, from the engineering standpoint, and from the public health standpoint, the intestinal tract seems like a dangerous place for this virus to be. During epidemics, the dissemination of poliomyelitis virus throughout the community is great, particularly when one considers how much virus may be present in a single human stool (for somewhere between 1,000 and 10,000 doses infective for the monkey have been demon-

* Read before the New Jersey Section of the American Water Works Association and the Engineering Section of the American Public Health Association at the Seventieth Annual Meeting in Atlantic City, N. J., October 16, 1941.

strated in a 50 gm. stool). Most of this dissemination occurs through carriers, which are usually unrecognized. Although in the more severe urban epidemics, the case rate is seldom greater than 1 per 1,000, this usually refers to the paralytic and frank cases. The more common, abortive cases harbor the virus as well if not better than the paralytic cases. They outnumber the paralytic cases by many times [6] and, as they are generally undiagnosed, they actually are the equivalent of transient healthy carriers. It is readily seen then how great a quantity of virus must enter urban sewers during epidemic times, and it becomes important to know something of the conditions under which it survives in this medium.

Before describing experiences with sewage, however, it is worth mentioning the fact that poliomyelitis virus is quite stable and more resistant to chemicals than certain bacteria such as *Escherichia coli*. This virus survives well in 15 per cent ether and in low dilutions of phenol. In suspensions of human feces it keeps at icebox temperature for months.[7] In sterile water, preserved in the light at room temperature, the virus has been found active after 31 days [8] and in the dark for 114 days.[9] In milk the virus has been found active after 25 days [8]; and at icebox temperatures after 180 days.[10] In butter it has survived at — 2° C. as long as 91 days.[11]

Poliomyelitis virus is killed by the same degree of heat which kills most bacteria, in other words, exposures of 45° to 50° C. for 30 minutes are sufficient to inactivate the virus.[12] Ultraviolet light is also known to be injurious to the virus *in vitro*, exposure for short periods such as 5 seconds may noticeably weaken the virus, and longer exposures inactivate it.[13]

A practical question in this connection is one which concerns the resistance of the virus to chlorine. This has proved to be a difficult problem to answer, and none of the experiments as yet reported in the literature lend themselves to ready interpretation or practical application. In our own laboratory we have been carrying on experiments with the assistance of the Chemical Division of the Wallace and Tiernan Company of Newark, N. J. We have used suspensions of virus from infected spinal cord (which has been the technic employed by most other workers in this field), and also suspensions of virus as it naturally occurs in the human stool from patients convalescent from the human disease. The work is not completed and the results have been somewhat irregular.

From the literature we find that Levaditi, Kling, and Lépine, in 1931,[14] found that 4 p.p.m. of Cl_2 was capable of rendering artificially contaminated, slightly turbid water non-infectious after 24 hours; while 0.4 p.p.m. was effective in clear preparations. Kempf and Soule, in 1940,[15] reinvestigated this problem employing a 1:1,650 suspension of (M.V.) virus in water to which varying amounts of Cl_2 had been added and found that 0.5 p.p.m., which is in excess of that usually employed in municipal water treatment, did not inactivate the virus of poliomyelitis in 1½ hours, but did so in 4 hours. The same investigators together with Pierce, in 1941,[16] next studied the effect upon the virus of sodium and calcium hypochlorite in tap water which gave a resulting Cl_2 concentration of 1.0 p.p.m. This failed to inactivate poliomyelitis virus after 4 hours' exposure, at the end of which time the Cl_2, however, had fallen to 0.2 p.p.m. A concentration of 1.5 p.p.m. of Cl_2 in tap water inactivated the virus in 20 minutes and a concentration of 0.55 p.p.m. inactivated it after 1 hour. It may be noted that the latter amount is equivalent or even in excess of that often employed in swimming pools.

So much for laboratory experiments.

The next question concerns the actual circumstances under which the virus of poliomyelitis has been demonstrated in water, or more accurately in sewage. To date there are seven tests in which this has been successfully accomplished in urban or hospital sewage during epidemic times. They include one positive test made in Charleston, S. C.,[17] three from a hospital sewer in Detroit,[17] one from Stockholm, Sweden,[18] and two from New York City.[19] Most of the positive tests have been obtained in the vicinity of hospitals, which is not surprising when one considers how resistant poliomyelitis is, and how much virus poliomyelitis patients may discharge. From the sewage studies it appears that the virus may still be detected when considerable dilution has taken place,[17] and we find that it may be transported by sewage for at least an eighth of a mile,[17] and perhaps for several miles.[19] Such findings raise the question, of course, as to whether or not poliomyelitis virus may not be a normal inhabitant of sewage, like tetanus bacilli or tubercle bacilli, for the mere presence of such organisms in sewage would tell us little about the epidemiology of the human infections which these bacteria cause.

It is desirable to know, therefore, whether or not poliomyelitis virus may not be present all the time in urban sewage—that is, winter and summer, in good years and bad. If it were present at all times, such a finding would be in keeping with one theory of the pathogenesis of this disease, namely, that we are constantly exposed to the virus, winter and summer, year in year out, and only when profound alterations occur among the local population does the clinical disease come to the surface. To answer this question, a series of 22 tests on 11 post-epidemic sewage samples has been made in four large cities.[17] All of them were negative. We have also made a series of 87 tests on sewage during inter-epidemic periods both in winter and summer.[19] Samples tested represented hospital sewers and main sewers in the City of New Haven; and one of the larger collecting sewers in New York City, namely the Manhattan Grit Chamber indicated in Figure 1. From all these tests which have been carried on monthly for almost two years now, two positive results have thus far been obtained from New York City in September, 1940, and October, 1941. These were not years of large epidemics in New York City but the first positive test was encountered in the local sewer in the month (September, 1940)

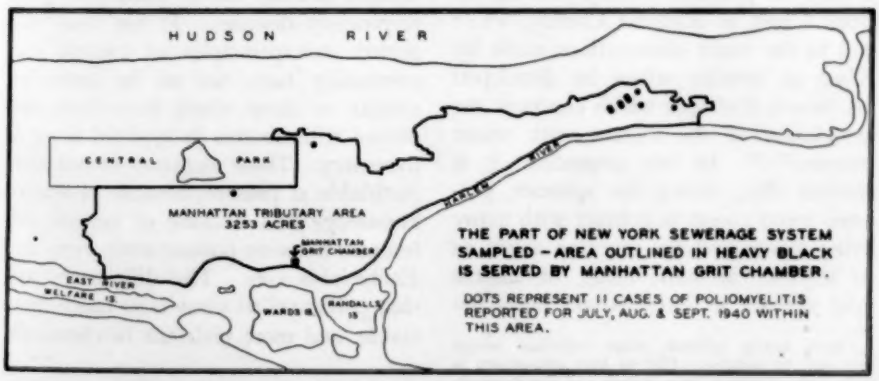
HUDSON RIVER
CENTRAL PARK
MANHATTAN TRIBUTARY AREA
3253 ACRES
MANHATTAN GRIT CHAMBER
EAST RIVER
WELFARE I.
WARDS I.
RANDALLS I.
HARLEM
THE PART OF NEW YORK SEWERAGE SYSTEM SAMPLED – AREA OUTLINED IN HEAVY BLACK IS SERVED BY MANHATTAN GRIT CHAMBER.
DOTS REPRESENT 11 CASES OF POLIOMYELITIS REPORTED FOR JULY, AUG. & SEPT. 1940 WITHIN THIS AREA.

FIGURE 1—An outline map which includes the northern part of Manhattan Island and indicates the geographical relationships of poliomyelitis cases to the site (Manhattan Grit Chamber) where poliomyelitis virus was detected in September, 1940

when cases of poliomyelitis had reached a peak for the year in that city. In 1941 a positive test was obtained in October, following an increase in local cases during August, September, and October.

Regardless of the significance of this finding, the periodic testing of sewers as an index of local case prevalence of the human disease may eventually turn out to have some practical value. It is not clear as yet what its degree of practicality may be, for one does not always find the virus of poliomyelitis in urban sewage in epidemic times.* Our methods for the detection of poliomyelitis are still crude, perhaps when they are improved the value of this technic can be judged in better fashion. So far, poliomyelitis virus has never been isolated from "river water" or from bathing beach water. A single questionable report from well water made in Sweden [20] would not fulfil the criteria which are demanded for a positive test in this country.

From circumstantial evidence, however, there has been reason to suspect certain polluted streams as occasionally being of significance from the standpoint of the spread of poliomyelitis. I refer to the suspicions of Caverly in Vermont in 1894, which he directed toward a polluted stream known as Otter Creek in Rutland County, Vt.,[21] and to the many observations made by Kling in Sweden where he developed his *theorie hydrique* which concerns the association of the disease with water courses.[22, 23] In this connection it is obvious that, during the summer, polluted water comes in contact with many living things and the question arises as to whether animals, birds, or insects may not act as intermediate hosts between the "reservoir" of the virus and man, such as is suspected in other summer virus diseases which attack the central nervous system in man, like equine encephalomyelitis of the Eastern and Western types, and St. Louis encephalitis.

A new finding which has only recently come to light and which may or may not have considerable significance in the epidemiology of poliomyelitis is the isolation of the virus of poliomyelitis from flies.[24] This has been done on two separate occasions in epidemics in Connecticut and Alabama. In both instances the "contaminated" flies were caught within areas where the prevalence of poliomyelitis was high and where proven human carriers were known to exist.* In both instances the flies had had the opportunity of feeding recently, both in and outside of privies, on human stools which may well have contained the virus. The possible carriage of the virus by these insects would explain much about the baffling nature of this disease. It is undoubtedly a problem which deserves grave consideration by the sanitary engineer.

In conclusion, therefore, recent work (whether rightly or wrongly) has served to place poliomyelitis among the intestinal diseases rather than among the respiratory diseases. It has been suggested that principles of control may eventually turn out to be somewhat similar to those which have been employed with success in typhoid fever or dysentery. These measures do not seem justifiable at present, because of limited knowledge and because of certain differences between poliomyelitis virus and *Escherichia coli*. The differences are, that poliomyelitis virus is so much more stable, and more resistant to chemicals.

* Even during epidemic times individual sewage tests may be negative. This we have encountered in tests made on sewage from Detroit and Frankenmuth, Mich.; Windsor, Canada; and Buffalo, N. Y., in 1939; Waterbury, Conn., in 1940; and in Miami and Pensacola, Fla.; Cleveland, Ohio; and Winnipeg, Manitoba, during 1941.

* Since this paper was written two other reports have appeared by Sabin and Ward,[25] and Toomey [26] which also describe the isolation of poliomyelitis virus from flies collected within epidemic areas.

Furthermore there is no assurance that the methods used successfully to purify and disinfect material contaminated with typhoid bacilli, for instance, would be successful with poliomyelitis virus. We are, as a matter of fact, quite in the dark as to the control of any virus disease which is also an intestinal disease. And in the control of poliomyelitis our ignorance remains profound. Among other things we still have to wait for more knowledge regarding the significance of insect vectors, and also regarding the existence (during epidemics) of other possible extra-human carriers of the virus, such as mammals or birds.

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Opsonocytophagic Reaction to Whooping Cough Vaccination

With Particular Reference to the Effect of Age upon the Response*

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IN recent years efforts to find an immunizing agent against whooping cough have been intensified. The fact that approximately 60 per cent of the fatalities from whooping cough occur in infants less than one year of age makes it important that any vaccination procedure developed to control the disease be efficacious in the very young infant. It seemed desirable, therefore, to study the serological responses of children of various ages, particularly young infants, to pertussis vaccine prepared by the method of Sauer.

Such an investigation would have point only if it is assumed that the vaccination procedure is effective in conferring immunity. Soon after the organism now called *Hemophilus pertussis* was isolated from cases of whooping cough by Bordet and Gengou attempts at immunization against this disease were carried out. The earlier reports of such attempts seemed favorable, but subsequent reports were unfavorable. In 1925, however, Madsen [1] reported on the modification of whooping cough by the use of vaccines during an epidemic in the Faroe Islands. The report of Leslie and Gardner in 1931 [2] on the degeneration phases of *Hemophilus pertussis* when grown on artificial media suggested that the vaccine of Madsen owed its potency to the fact that it was prepared from recently isolated strains of the organism.

In 1933,[3] Sauer published the first of his reports on the use of large injections of a vaccine prepared from recently isolated strains of *Hemophilus pertussis* grown on a medium which retards degeneration. He was able to show that the vaccine conferred an apparent immunity. Subsequently, these studies have been confirmed by field trials with similar vaccines by Kendrick and Eldering,[4] Silverthorne,[5] Singer-Brooks,[6] Miller and Faber,[7] and others.[8, 9, 10] Doull and Shibley and their coworkers in a similar study were unable to show substantial protection against the infection or modification of the disease. They used a vaccine which differed from Sauer's in that the bacteria were washed once with distilled water.

Table 1 summarizes the results of some of the field studies on whooping cough vaccination. Variation in these results may be explained in part on the basis of the differences in the preparation of the vaccines and in the dosage used. This table suggests that large doses of a properly prepared *Hemophilus pertussis* vaccine may confer a certain

* Read before the Epidemiology Section of the American Public Health Association at the Seventieth Annual Meeting in Atlantic City, N. J., October 14, 1941.

TABLE 1

Field Studies on Whooping Cough Vaccination

Year of Study	Author	No. Vaccinated Individuals	Number Exposed	Number of Cases	Primary Attack Rate	Secondary Attack Rate	Number Controls	Number Exposed	Number of Cases	Primary Attack Rate	Secondary Attack Rate
1938	Silverthorne	747	91	2	0.3	2.2	161	27	23	14.2	85.1
1938	Kendrick Eldering	1,851	311	52	2.8	16.8	2,397	434	348	14.5	80.2
1938	Singer Brooks	272	42	7	2.6	16.6	256	71	62	24.2	87.2
1939	Sauer	2,453	..	32	1.3	....	1,730	..	286	16.5	....
1939	Doull, Shibley, et al.	342	?	54	15.8	....	385	?	70	18.2	....
1939	Miller Faber	346	42	11	3.2	26.2	182	36	32	17.6	88.9

Modified from Miller, J. J., *California & West. Med.*, 53:25, 1940.

amount of immunity.† Acting on this assumption the serological responses of infants and older children following injection of pertussis vaccine were observed and compared to see whether there were any differences.

MATERIAL AND EXPERIMENTAL METHODS

The children selected for our investigation were patients attending the outpatient pediatric clinic of Vanderbilt University Hospital. They ranged in age from 6 weeks to 3 years and included 331 white and 50 negro children. Because of the small number of negro children no attempt has been made to study the two races separately. Selections were made on the basis of freedom from active disease processes and upon the desire and the ability of the mothers to coöperate. Most of the children were healthy infants who were being followed in the clinic for regulation of their diets and for routine immunizations.

The observations reported in this paper cover the period from October, 1938, to January, 1941. The children have been divided into two groups, A and B. Group A consists of 293 children who received a course of vaccination in a 4 weeks' period, plus 44 children who had not completed their course of vaccination but who had adhered to the vaccination schedule up to their last observation. The total number of children in Group A, therefore, is 337. The age distribution of these children is as follows:

Age	Number of individuals
Less than 3 months	74
3– 5 months	89
6–12 months	79
Over 1 year	95
	337

Group B consists of 44 children who received the same total amount of vaccine as those in Group A, but the injections were irregularly spaced over a period ranging from 5 through 10 weeks. The age distribution of the children in Group B is essentially the same as that of the children in Group A.

As far as could be determined by careful questioning of the mothers, none of the children in either group had had whooping cough previously. The great majority had had no known exposure to

† Since preparation of this article Rambar, *et al.*,[12] have reported another study indicating that "there is a definite reduction in the incidence and severity of whooping cough following vaccination with phase I, *Hemophilus pertussis* vaccine."

whooping cough and care was taken in the clinic to isolate the children in the study group from known contacts of whooping cough cases. Excluded from the study group were all children who developed pertussis any time within 6 weeks after the initial injection.

There were 57 children who started but never completed the vaccination course. This failure to continue was very rarely due to objections to the vaccination, but was in the main the result of the inability of the mothers to bring the children back to the clinic and of general lack of coöperative spirit.

The routine vaccination procedure used was to give a series of five 1 ml. subcutaneous injections of a vaccine containing 20 billion organisms per ml. over a period of 4 weeks. The vaccine was prepared as authorized by Sauer.* The five dose method of vaccination was chosen primarily to avoid injecting doses larger than 1 ml. No reactions either local or general were encountered which were of sufficient severity to warrant either delaying or discontinuing the injections except in the case of one child. This child had a convulsion during the febrile response which usually accompanied the first and second injections. Subsequently, the child was given smaller and finally full-sized doses without recurrence of the convulsions.

Previous studies by others have shown that specific complement-fixing, agglutinating, and opsonic antibodies appear in the blood of patients following whooping cough and after the injection of potent *Hemophilus pertussis* vaccine. Although it is generally conceded that these phenomena of serological activity may be the result of varying expressions of a single antibody, the precise relationship of this antibody to immunity is indefinite. In this study the opsonocytophagic test employed by Kendrick and her coworkers [13] was used as a measure of the antibody response.† This test was chosen because of the ease with which it could be performed. Kendrick found that the tests are negative or weakly positive in normal individuals and that an attack of whooping cough or injections of whooping cough vaccine induces a rise in opsonins, and that the reaction has a satisfactory degree of specificity.

Stained films were prepared and 25 intact polymorphonuclear neutrophilic leucocytes were examined and classified according to the estimated number of bacteria per leucocyte. Those cells showing no phagocytosed bacteria were called negative and the cells containing bacteria were classified as follows: 1–5, 6–20, 21–40, 41–100. This gradation does not necessarily represent a proportionate increase in pertussis antibody, but is merely a convenient classification. The average number of bacteria per leucocyte was then determined for each test performed. A certain number of tests were found to be unsatisfactory. In most instances this was due to inadequate mixing of the citrate and the blood with resulting clot formation. In tests from some of the smaller infants it was difficult to find 25 satisfactory cells in a stained film. These unsatisfactory tests have been noted in the tabulations.

Plate I shows photomicrographs of leucocytes with varying degrees of phagocytosis.

The opsonocytophagic tests were usually performed before the first injection of vaccine, at the time of the fifth injection, and 2 weeks later. Scattered tests were made during the vaccination and afterward at varying weekly intervals when vaccinated children returned for various reasons.

RESULTS

Table 2 and Figure 1 show the opso-

* The vaccine for this study was supplied by Dr. W. A. Jamieson of the Eli Lilly Research Laboratories.

† The antigen used for the opsonocytophagic tests was supplied by Dr. Pearl Kendrick of the Western Division, Michigan State Laboratories.

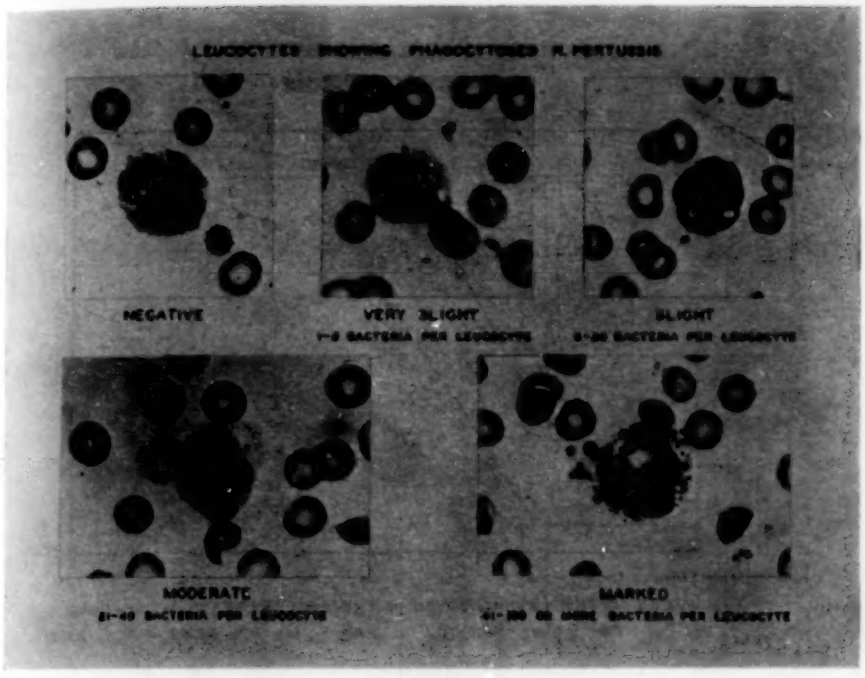


PLATE 1

nocytophagic response of the children of Group A as a whole. The table indicates the number of tests showing a given level of phagocytic activity expressed in terms of the average number of bacteria per leucocyte according to the time in weeks following the first injection of vaccine. Figure 1 shows the opsonocytophagic response in terms of the percentage of tests showing any phagocytic

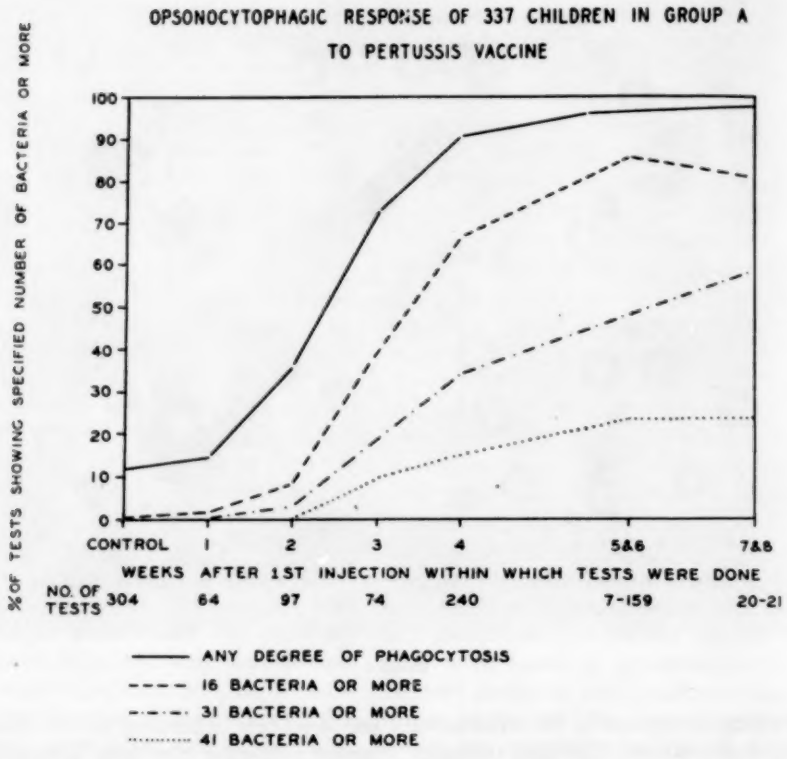
TABLE 2

Opsonocytophagic Response of 337 Children in Group A to Vaccination Against Whooping Cough

Average Number of Bacteria per Leucocyte	Number of Tests							Per cent of Tests Showing Specified Number of Bacteria or More						
	First Test before First Injection	Weeks after First Injection						First Test	Weeks after First Injection					
		1	2	3	4	5–6	7–8		1	2	3	4	5–6	7–8
Negative	268	55	62	20	22	7	1	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1– 5	34	6	19	8	20	7	..	11.8	14.1	36.1	73.0	90.8	95.8	97.6
6–10	1	2	4	8	21	4	2	0.7	4.7	16.5	62.2	85.2	91.6	97.0
11–15	..	..	4	9	17	6	5	0.3	1.6	12.4	51.4	73.8	89.2	92.7
16–20	..	1	4	5	27	18	4	0.3	1.6	8.3	39.2	66.7	85.5	80.5
21–30	1	..	1	10	50	43	5	0.3	.....	4.1	32.4	55.4	74.7	70.7
31–40	..	..	3	7	47	42	14	.....	.....	3.1	18.9	34.6	48.8	58.5
41–50	..	..	..	3	26	26	6	.....	.....	.....	9.5	15.0	23.5	24.4
51–60	..	..	..	4	10	10	4	.....	.....	.....	5.4	4.1	7.8	9.8
61–70	..	..	..	..	..	3	..	.....	.....	.....	.....	.....	1.8	.....
Unsatisfactory or lost *	5	4	1	2	17	24	5	.....	.....	.....	.....	.....	.....	.....
Total	309	68	98	76	257	190	46							

* Unsatisfactory or lost omitted from per cent computations

FIGURE 1



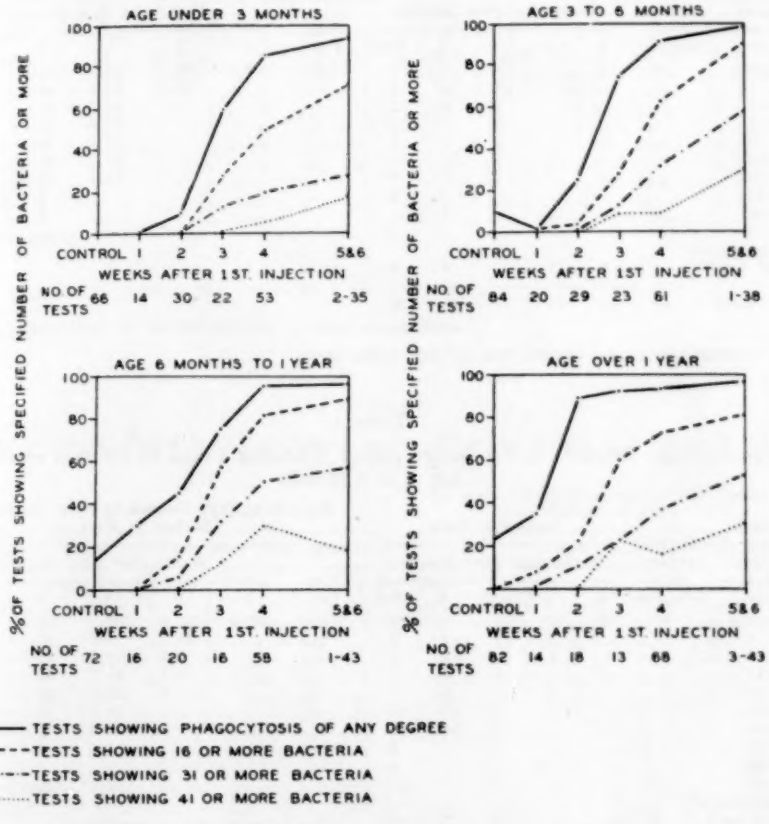
activity, 16, 31, and 41 bacteria or more per leucocyte respectively.

In the control tests for Group A, only 11.8 per cent of the individuals showed any phagocytic activity at all and in almost all of the instances where phagocytic activity was found the number of bacteria phagocytosed was less than 6 per leucocyte. Approximately the same degree of phagocytosis was found in tests run 1 week after the first injection. Two weeks following the first injection the per cent of tests showing phagocytosis rose to 36.1 and then rapidly to 95.8 per cent by the end of the 6th week following the first injection.

However, inasmuch as some control test may show phagocytic levels of 1–5 bacteria per leucocyte, phagocytosis of this degree in subsequent tests should not be considered significant, although this phagocytic action may actually represent a response to the injections. On this basis, 91.6 per cent of the individuals 6 weeks after the first injection showed an increase in phagocytic activity. Of the individuals tested at this time 85.5 per cent showed levels of phagocytic activity of 16 bacteria or more, and almost half showed 31 bacteria or more. It is also seen that by the 7th and 8th weeks after the first injection (3 and 4 weeks after the completion of the course of injections) the curves of response have begun to level off. While the tests performed 3 or 4 weeks after the last injection are relatively few in number it seems probable that the maximum of the serological antibody response occurs somewhere in the neighborhood of 2 to 3 weeks following the last injection.

FIGURE 2

OPSONOCYTOPHAGIC RESPONSE OF CHILDREN IN GROUP A TO PERTUSSIS VACCINE ACCORDING TO AGE


AGE UNDER 3 MONTHS
AGE 3 TO 6 MONTHS
AGE 6 MONTHS TO 1 YEAR
AGE OVER 1 YEAR
% OF TESTS SHOWING SPECIFIED NUMBER OF BACTERIA OR MORE
100
80
60
40
20
0
CONTROL 1 2 3 4 5&6
WEEKS AFTER 1ST. INJECTION
NO. OF TESTS 66 14 30 22 53 2-35
NO. OF TESTS 84 20 29 23 61 1-38
NO. OF TESTS 72 16 20 16 58 1-43
NO. OF TESTS 82 14 18 13 68 3-43
TESTS SHOWING PHAGOCYTOSIS OF ANY DEGREE
TESTS SHOWING 16 OR MORE BACTERIA
TESTS SHOWING 31 OR MORE BACTERIA
TESTS SHOWING 41 OR MORE BACTERIA

Further examination of the data for Group A (Tables 3, 4, 5, and 6 and Figure 2) reveals progressive changes in the response to vaccination according to the age of the individuals tested. In the control tests of the age group less than 3 months no phagocytic activity was ever found, while in the control tests of the group 3 through 5 months of age, 8.3 per cent showed phagocytosis. This figure rose to 23.7 per cent in children older than 1 year. In only two instances, however, was the degree of phagocytosis on the control test greater than 5 bacteria per leucocyte. Both of these instances occurred in children in the oldest age group, one of whom showed phagocytosis of 6 to 10 bacteria and the other 21–30 bacteria per leucocyte.

It is shown in the graphs that one result of the aging of the individuals is an increase in the rapidity with which phagocytic activity is induced. Two weeks after the first injection of vaccine there was found with each higher age group a greater percentage of tests showing 16 bacteria or more per leucocyte. In the two oldest age groups there were even a few tests showing 31

TABLE 3

Opsonocytophagic Response to Vaccination against Whooping Cough of Children in Group A Age Under 3 Months

Average Number of Bacteria per Leucocyte	First Test before First Injection	Number of Tests: Weeks after First Injection 1	2	3	4	5–6	Per cent of Tests Showing Specified Number of Bacteria or More: First Test	Weeks after First Injection 1	2	3	4	5–6
Negative	66	14	27	9	8	3	100.0	100.0	100.0	100.0	100.0	100.0
1– 5	..	..	3	3	10	3	.....	.....	10.0	59.1	84.9	91.9
6–10	..	..	..	1	6	2	.....	.....	.....	45.4	66.0	83.8
11–15	..	..	..	3	3	3	.....	.....	.....	40.9	54.7	78.4
16–20	..	..	..	1	4	5	.....	.....	.....	27.3	49.1	70.3
21–30	..	..	..	2	12	11	.....	.....	.....	22.7	41.5	56.8
31–40	..	..	..	3	7	4	.....	.....	.....	13.6	18.9	27.0
41–50	..	..	..	..	2	4	.....	.....	.....	.....	5.7	16.2
51–60	..	..	..	..	1	..	.....	.....	.....	.....	1.9	5.4
61–70	..	..	..	..	..	2	.....	.....	.....	.....	.....	5.4
Unsatisfactory or lost *	1	2	1	..	8	9	.....	.....	.....	.....	.....	.....
Total	67	16	31	22	61	46						

* Unsatisfactory or lost omitted from per cent computations

TABLE 4

Opsonocytophagic Response to Vaccination against Whooping Cough of Children in Group A Age 3 to 6 Months

Average Number of Bacteria per Leucocyte	First Test before First Injection	Number of Tests: Weeks after First Injection 1	2	3	4	5–6	Per cent of Tests Showing Specified Number of Bacteria or More: First Test	Weeks after First Injection 1	2	3	4	5–6
Negative	77	20	22	6	6	1	100.0	100.0	100.0	100.0	100.0	100.0
1– 5	7	..	5	4	5	1	8.3	.....	24.1	73.9	90.2	97.4
6–10	..	..	1	3	8	1	.....	.....	6.9	56.5	82.0	94.9
11–15	..	..	..	4	4	1	.....	.....	3.4	43.5	68.8	92.3
16–20	..	..	1	..	6	2	.....	.....	3.4	26.1	62.3	89.7
21–30	..	..	..	3	13	11	.....	.....	.....	26.1	52.5	84.6
31–40	..	..	..	1	14	11	.....	.....	.....	13.0	31.2	56.4
41–50	..	..	..	2	3	8	.....	.....	.....	8.7	8.2	28.2
51–60	..	..	..	..	2	3	.....	.....	.....	.....	3.3	7.7
61–70	..	..	..	..	..	..	.....	.....	.....	.....	.....	.....
Unsatisfactory or lost *	1	..	..	1	5	6	.....	.....	.....	.....	.....	.....
Total	85	20	29	24	66	45						

* Unsatisfactory or lost omitted from per cent computations

bacteria or more per leucocyte at this time. By the 3rd week all of the age groups except the youngest showed a few tests with 41 bacteria or more per leucocyte. The consistent increase with age of both the amount and degree of phagocytic activity up to about the 4th week after the initial injections suggests that the earlier response of older individuals may be associated with the general increase in phagocytic activity with age which is shown by the control tests.

Six weeks after the initial injection of vaccine, with the exception of the youngest age group, the earlier response of older individuals to antigenic stimuli had little influence with respect to the levels of phagocytosis reached at this time. This point is so similar in the age groups over 3 months as to indicate that the maximum level of phagocytic ac-

TABLE 5

Opsonocytophagic Response to Vaccination against Whooping Cough of Children in Group A Age 6 Months to 1 Year

Average Number of Bacteria per Leucocyte	Number of Tests: First Test before First Injection	Number of Tests: Weeks after First Injection 1	2	3	4	5–6	Per cent of Tests Showing Specified Number of Bacteria or More: First Test	Weeks after First Injection 1	2	3	4	5–6
Negative	62	12	11	4	3	2	100.0	100.0	100.0	100.0	100.0	100.0
1– 5	10	3	4	..	2	..	13.9	25.0	45.0	75.0	94.8	95.4
6–10	..	1	..	2	1	1	.....	6.2	25.0	75.0	91.4	95.4
11–15	..	..	2	1	5	2	.....	.....	25.0	62.5	89.7	93.2
16–20	..	..	2	3	6	4	.....	.....	15.0	56.2	81.0	88.6
21–30	..	..	..	1	12	10	.....	.....	5.0	37.5	70.7	79.5
31–40	..	..	1	3	12	17	.....	.....	5.0	31.2	50.0	56.8
41–50	..	..	..	..	12	4	.....	.....	.....	12.5	29.3	18.2
51–60	..	..	..	2	5	4	.....	.....	.....	12.5	8.6	9.1
61–70	..	..	..	..	..	..	.....	.....	.....	.....	.....	.....
Unsatisfactory or lost *	1	2	..	1	3	3	.....	.....	.....	.....	.....	.....
Total	73	18	20	17	61	49						

* Unsatisfactory or lost omitted from per cent computations

TABLE 6

Opsonocytophagic Response to Vaccination against Whooping Cough of Children in Group A Over 1 Year of Age

Average Number of Bacteria per Leucocyte	Number of Tests: First Test before First Injection	Number of Tests: Weeks after First Injection 1	2	3	4	5–6	Per cent of Tests Showing Specified Number of Bacteria or More: First Test	Weeks after First Injection 1	2	3	4	5–6
Negative	63	9	2	1	5	1	100.0	100.0	100.0	100.0	100.0	100.0
1– 5	17	3	7	1	3	3	23.2	35.7	88.9	92.3	92.6	97.8
6–10	1	1	3	2	6	..	2.4	14.3	50.0	84.6	88.2	91.3
11–15	..	..	2	1	5	..	1.2	7.1	33.3	69.2	79.4	91.3
16–20	..	1	1	1	11	7	1.2	7.1	22.2	61.5	72.1	91.3
21–30	1	..	1	4	13	11	1.2	.....	16.7	53.8	55.9	76.1
31–40	..	..	2	..	14	10	.....	.....	11.1	23.1	36.8	52.2
41–50	..	..	..	1	9	10	.....	.....	.....	23.1	16.2	30.4
51–60	..	..	..	2	2	3	.....	.....	.....	15.4	2.9	8.7
61–70	..	..	..	..	..	1	.....	.....	.....	.....	.....	2.2
Unsatisfactory or lost *	2	..	..	..	1	4	.....	.....	.....	.....	.....	.....
Total	84	14	18	13	69	50						

* Unsatisfactory or lost omitted from per cent computations.

tivity may be the same for these ages. For infants under 3 months the response 6 weeks after the first injection is not as great as in the older ages.

To determine the effect of irregular spacing of the vaccine injections on the response to vaccination, Table 7 was prepared showing a comparison of Group A and Group B. The comparison is made 2 weeks after the 5th injection of vaccine since it is not feasible to examine the responses of Group B except at a definite period after completion of the course of vaccination. It is apparent from Table 7 that the extra periods of 1, 2, and 3 weeks between different injections at varying stages of the vaccination course had very little effect on the degrees of phagocytosis demonstrated 2 weeks after the last injection.

TABLE 7

Comparison of Opsonocytophagic Response of Children in Group A and Group B

Average Number of Bacteria per Leucocyte	Number of Tests		Per cent of Tests Showing Specified Number of Bacteria or More	
	Group A	Group B	Group A	Group B
Negative	7	1	100.0	100.0
1–5	7	1	95.8	97.7
6–10	4	2	91.6	95.4
11–15	6	..	89.2	90.7
16–20	18	6	85.5	90.7
21–30	43	12	74.7	76.7
31–40	42	9	48.8	48.8
41–50	26	10	23.5	27.9
51–60	10	2	7.8	4.6
61–70	3	..	1.8	....
Unsatisfactory or lost *	24	1	....	....
Total	190	44		

* Unsatisfactory or lost omitted from per cent computations.

RESPONSE AFTER STIMULATING INJECTIONS

Observations were also made to determine the effect of a single stimulating injection of vaccine on the opsonocytophagic values when administered to vaccinated individuals sometime after the original course of vaccination. Due to difficulties in maintaining contact with patients over a period of many months it was not possible to accumulate any sizeable experience with the response following stimulating injections. We have, however, succeeded in getting 48 children back for both the stimulating injection and a later test. Control opsonocytophagic tests were performed at the time of the stimulating injection and response tests were made 2 weeks later. The stimulating injections were given subcutaneously and the size of the dose was either 0.5 ml. or 1.0 ml. These observations were made usually a year after the primary vaccination, but in a few instances the time interval was as short as 6 months.

Stimulating injections were also given to a group of individuals who had received the "standard" Sauer's vaccination * 1 to 5 years before. The dose for these individuals was 0.25 ml. given subcutaneously. These children were private patients and as a whole were considerably older than the clinic group.

Table 8 shows the level of opsonins at the time of the stimulating injection compared with the response observed 2 weeks later, according to the size of the stimulating injection. It is apparent that there is a rise of opsonins following the injection of a small stimulating dose of antigen. Comparison of the magnitude of response to the different size doses cannot be made, however, because of the differences in age distribution and the length of time since vaccination of the three groups. However, those children in the clinic group who received 1.0 ml. of vaccine as a stimulating dose showed a rise comparable to that attained following primary vaccination.

In 2 individuals in the tables shown and in 3 others whose tests have been left out because the time of the tests was irregular, we observed a decline in opsonins following the stimulating injections. Of these individuals, 3 were in the group who received 0.25 ml. as a stimulus and 1 each in the groups receiving 0.5 and 1.0 ml. Prior to injection all of these children had a relatively high level of opsonic activity and the degree of decline was never more than from one class to the next lower class.

SUMMARY AND DISCUSSION

Various field investigations of whooping cough vaccination procedures have indicated that large doses of a properly prepared *Hemophilus pertussis* vaccine produces immunity in a large proportion of the children. Assuming this to be true it seemed particularly desirable to investigate the effect of age on the serological responses of children to such vaccination.

* This consists of administering a total of 3 ml. of vaccine containing 10 billion organisms per ml. over a period of 3 weeks, 1.0 ml. being given bilaterally the first week, and 1.5 ml. bilaterally the second and third weeks.

TABLE 8

The Relation of Size of Dose to Opsonocytophagic Response Two Weeks after Stimulation

Average Number of Bacteria per Leucocyte	Number of Tests According to Size of Stimulating Dose						Per cent of Tests Showing Specified Number of Bacteria or More					
	0.25 ml.		0.5 ml.		1.0 ml.		0.25 ml.		0.5 ml.		1.0 ml.	
	Control	2 Weeks After	Control	2 Weeks After	Control	2 Weeks After	Control	2 Weeks After	Control	2 Weeks After	Control	2 Weeks After
Negative	8	..	4	..	4	..	100.0	.....	100.0	.....	100.0	.....
1–5	5	..	3	1	1	..	42.9	.....	77.8	100.0	76.5	.....
6–10	..	..	2	3	5	..	7.1	.....	61.1	94.4	70.6	.....
11–15	1	1	2	1	..	..	7.1	100.0	50.0	77.8	41.2	.....
16–20	..	1	3	..	..	..	.....	92.9	38.9	72.2	41.2	.....
21–30	..	6	2	6	2	3	.....	85.7	22.2	72.2	41.2	100.0
31–40	..	4	2	3	1	2	.....	42.9	11.1	38.1	29.4	83.3
41–50	..	2	..	4	3	9	.....	14.3	.....	22.2	23.5	72.2
51–60	..	..	..	..	1	1	.....	.....	.....	.....	5.9	22.2
61–70	..	..	..	..	..	3	.....	.....	.....	.....	.....	16.7
Unsatisfactory or lost *	..	..	..	..	2	1	.....	.....	.....	.....	.....	.....
Total	14	14	18	18	19	19						

* Unsatisfactory or lost omitted from per cent computations.

The measure of antibody response to whooping cough vaccination which we have used in this study is the opsonocytophagic reaction. It was recognized that the exact relation of this reaction to immunity is difficult to define, but it does not seem probable that a high degree of immunity can be developed without an opsonocytophagic response. Viewed in this way the results of the opsonocytophagic tests reported here suggest certain points which may be considered in attempting to develop a means for the control of whooping cough.

In this study it has been shown that the majority of infants and young children respond when systematically injected with a properly prepared *Hemophilus pertussis* vaccine by the production of relatively high levels of opsonic activity against the injected organisms. It is particularly noteworthy that very young infants, 6 weeks or more, seemed able to tolerate large injections of vaccine without reactions of serious consequence. The response to vaccination varied with the age of the child. Children under 3 months of age did not respond quite as rapidly as children over 3 months of age. In general, the older the child the more rapidly a rise in phagocytic activity could be evoked.

It was also noted, however, that the degree of phagocytosis *prior* to vaccination varied with age in the same manner as the results of the opsonocytophagic tests after vaccination. This would suggest that perhaps in the younger infants there has been a lack of previous nonrelated infections which would serve as stimuli which would condition their response to vaccination.

The rapidity with which the opsonocytophagic response could be induced varied with age, but the capacity to respond seemed the same for all the ages investigated with the exception of children under 3 months.

The above findings have particular significance for the possible development of programs for the prevention of whooping cough by vaccination. The fact that vaccination can be done in the very young infant, where the major problem lies, is encouraging. The data suggest that dosages equal to or larger than those used in older children be used in immunizing the very young child. This and other points of the

vaccination procedure, such as the number of injections, are details which are open for further investigation.

Little information is available on the duration of protective immunity which may follow whooping cough vaccination. In this study relatively high levels of antibodies were found in many of the children a year or more after vaccination, but some of the children showed at that time very little or no phagocytosis. Those showing persistently elevated levels may have had exposure to whooping cough which served to maintain the level or they may represent individuals in whom the antibody level declines slowly, or both.

Although the level of opsonins remained relatively high for some time after the initial course of vaccination, there was a decline from the maximum level of response. The finding, therefore, that a single injection of vaccine 6 months to 5 years after primary vaccination serves to stimulate a rise in the opsonocytophagic response, is particularly pertinent. It suggests the possibility that in the young, where the disease is most apt to be severe and most likely to be attended by a fatal outcome, stimulating injections given at yearly intervals may help to prevent and control the diseases. Such injections may also be given whenever a familial exposure to the disease occurs.

The best method of administering such stimulating injections requires further study. Further investigation is necessary both in the field and in the laboratory to determine the most feasible method of vaccination as a procedure in the public health program for the control of whooping cough.

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Errors in Clinical Statements of Causes of Death*

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THIS is the first of a series of contributions upon the statistical expression of error in certification of causes of death, based upon clinical findings and opinion, when compared with post-mortem protocols of the same cases. The primary collection of data and the plan of study have been under the auspices of the Joint Committee on Autopsies of the American Public Health Association and the American Hospital Association.

It has been planned to assemble records of 100,000 autopsied deaths (1900–1939) occurring in general hospitals where there was full-time pathologist service and a high average ratio of autopsies to deaths. Private funds have permitted the completion of 25,000 records prior to July 1, 1941, and it is hoped that another 20,000 can be obtained in the next twelve months.

Mortality rates as they appear in official reports of vital statistics by health department or other government bureaus are affected by the two variables of frequency of occurrence and fatality of the respective diseases, and by the degree of accuracy inherent in the process of certification, registration, and tabulation of death returns.

An instance of the confusion and uncertainty as to death rates for an important cause of death was the discussion a decade or two age concerning the reality of increase in cancer mortality. A definite answer must depend in this, as in similar questions, upon a recognition and correction of errors in clinically established statements of causes of deaths.

Discussions upon errors in clinical statements of causes of death will remain unprofitable until we begin to study by exact statistical methods the problem of diagnostic errors itself. There are only five attempts known to us in the literature dealing statistically with accuracy of diagnostic statements, all comparing clinical statements upon causes of death with autopsy protocols.[1-4]

In addition we have had access to the original text of a paper presented on this subject by George H. Van Buren before the Statistical Section of the American Public Health Association at its meeting in Chicago, Ill., in 1918, but not published.

The data used in the present report

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* Read before the Vital Statistics Section of the American Public Health Association at the Seventieth Annual Meeting in Atlantic City, N. J., October 17, 1941.

NOTE 1—Dr. Kurt Pohlen has been responsible for the statistical analyses now presented. Drs. Eric Seligmann and Kurt Hirschmann have assisted in the abstracting, sorting, tabulation, analysis and interpretation of the clinical records and autopsy protocols.

NOTE 2—Additional tables and charts not published in the *Journal* because of lack of space may be obtained by writing either author.

FIGURE I

Abstract Form

Male, Female	White, Negro, Other	..... Year of Death	.... Age	..... Hospital	..... Autopsy Number	..... History No.	Autop. Full / Skull only / Trunk only

AUTOPSY: ..... Primary cause of death	Ac.Chr.Bronchitis	——Rheum. Bact. Endocarditis	
	Bronchopneum.	Mitral Sten. Insuff.	Hypertension
	Lobar Pneum.	Aortic Sten. Insuff.	Gen.Arteriosclerosis
	Bronchiectasis	Tricus.Sten.Insuff.	Art.Aorta,Pulm.Art
	Atelectasis	Card.Hyper.Dilat.	Patent Foramen ovale
	Emphysema lungs	Coron.Scler.Occlus.	Hydrotrorax/Ascites
	Ac.Fibr.Pleurisy	Myocard. Fibr.——	Edema: Lung, Low.Ex.
CLINICAL: ..... Primary cause of death	Cholelithiasis	—Pericarditis	" :——
	Cholecystitis	—Glomerulonephr.	Abscess: Lung,Kid.Liv.
	Cholangitis	Nephrosclerosis	" :——
	LiverCirrh.Atr.Bil.	—Pyelonephritis	Infarct/Embolie
	" " ,Card.	Uremia	——
CLINICAL: Secondary causes and findings:	Peribepatitis	Pros. Hypertrophy	Thromb. in veins of:
	Perisplenitis	Ur.Blad.Hyper.Dil.	
	Splenomegaly	Cystitis ——	
	Bacteremia w. Met.	Hemorrh/Petecha:	Brain,Lungs,Kidney,Spl.
	Loc. Diff Periton.	Diverticula:	Colon,Sigmoid,Bladder.Duod.
Laborat. Findings—Biopsy or surgical specimen Electrocardiogr.—X-rays—Operat. without spec.	Myoma Uteri	Cysts:	Kidneys, Ovaries, ——
	Ulcer: Stom.Duodn.	Polyps:	Colon,Sigmoid,Rectum,Uterus,—
	Syphilis clin.Aorta	Adenoma:	Thyroid,Adrenal,Kidney,——
	Lipoma Pancreas	Tuberc.Active,Healed,Lung;	Lymph N.——
ADMISSION: Diagnosis	.....	.....	.....
	.....	.....	.....
	.....	.....	.....
	.....	.....	.....
	.....	.....	.....
	.....	.....	.....
	.....	.....	.....

First Admission
Readmission

were abstracted from the official case histories and autopsy protocols made accessible through the courtesy of the administrators and record room clerks of fifteen hospitals in New York City, Albany, Schenectady, Rochester, and Buffalo, N. Y., and in Jersey City, N. J., for the 10 year period, 1930 to 1939. The abstract form (Figure I) has been used throughout.

Besides some items to identify the patient and a copy of the primary cause of death, which usually forms the basis of mortality statistics, we list for every case all secondary and contributory conditions found at autopsy as well as clinical statements; further, we record the diagnosis on admission to the hospital, which is very often merely a statement upon some symptom; and finally note some diagnostic procedures used (laboratory, x-rays, electrocardiogram, biopsy or surgical specimen and operation without specimen) and the fact whether or not this was the first admission of the patient to hospital for the present disease.

The accuracy of clinical statements upon causes of death varies from one possible extreme to the other. Some diseases are diagnosed accurately by clinical examination. Such are often chronic diseases requiring several long stays in the hospital, and verified by use of ample diagnostic facilities, as x-rays and laboratory tests. In the first line of accuracy among important diseases stands pulmonary tuberculosis with slightly less than 98 per cent accurate clinical diagnosis. Next in accuracy of diagnosis come the acute communicable diseases — diphtheria, measles, whooping cough, scarlet fever, where 96–98 per cent of all clinical diagnoses of causes of death are correct. Most mistakes of record in death certification

of these diseases are due to mentioning secondary stages of such diseases instead of the origin of the infection (*e.g.*, otitis media and encephalitis). Then follow deaths due to accident, the causes of which usually are quite accurately stated.

To give an idea of the methods and results of our study we offer a brief discussion of deaths from malignant tumors. From the records of ten general hospitals, totalling about 20,000 cases, we found 4,051 cases in which either upon autopsy, or by clinical statement of cause of death, or in the admission diagnosis to hospital some form of malignant or unspecified tumor was mentioned. Among the 4,051 cases were 3,462 in which the autopsy report showed some form of malignancy as primary cause of death, including a minority of cases where the tumor was contributory to another disease.

In addition to these 3,462 cases were 271 cases in which the malignant tumor, usually in a very early stage, caused no clinical symptoms and was incidentally discovered in the course of the autopsy as a contributory condition.

The problem of diagnostic accuracy must be considered from two different and quite independent points of view: the topographic or anatomic site and etiological diagnosis. A diagnosis is wholly accurate only when both factors, the etiologic and topographic, are correct. All other diagnoses must be looked on as more or less incorrect. The problem is to divide the cases into categories of greater and lesser accuracies. Let us compare for instance two kinds of diagnostic changes by autopsy: first, where clinically an intestinal malignant obstruction was mentioned, which at autopsy proved to have been due to a cancer of the sigmoid, or where the clinical statement was carcinoma of the bile ducts and the corresponding pathologic statement carcinoma of the pancreas with metastases in the bile ducts and colon; and, second, where clinically a liver cirrhosis was observed which proved to be a carcinoma of the liver secondary to cancer of the stomach. In the first two instances the clinical diagnoses were at least partly correct, and in the third case there is a real mistake. We have based all changes of diagnosis upon the autopsy findings. We have classified each diagnosis according to its etiologic and topographic accuracy, and have distinguished five

TABLE 1

Diagnostic Approval of Clinical Statements of Causes of Death by Autopsy Topographically

Cases of malignant tumors as found with autopsy were previously diagnosed at Clinical statement of causes of death		*Correct*	*Partly Correct*		*Incorrect*		*Total*
			Site of extension or metastasis was mistaken for primary site	*Site of malignancy was given only in general terms of body region or cavity*	*Other organ was mistaken for site of tumor*	*No site of disease was given*	
Correct		2,311	145	26	97	93	2,672
Etiologically Partly correct	Other distinct form of malignancy was mistaken for correct form of tumor	37	9	7	15	19	87
	Nature of tumor was given only in general terms as "malignancy" or "tumor"	174	48	31	18	16	287
Incorrect	Non-malignant disease was mistaken for correct tumor	119	29	18	113	28	307
	No form of disease was given	23	5	24	16	41	109
	Total	2,664	236	106	259	197	3,462

All Forms of Malignant Tumor.

TABLE 2

Malignant Tumors According to Correct Clinical Diagnoses and Cases of Malignancy Contributory to Other Diseases

Primary site of malignancy	*Total of malignancies as diagnosed by autopsy*	*Cases diagnosed correctly at clinical statement of causes of death*					*Cases of malignancy found additionally to cases of column 2 as contributory causes to other non-malignant primary causes of death*		*Cases diagnosed as malignancy or unspecified form of tumor not verified at autopsy to be any form of malignancy*	
		With regard to both topographic and etiologic statement			*With regard to topographic etiologic statements only*					
	Primary causes of death only	*Number*	*% of col. 2*	*also correctly diagnosed at admission to hospital*	*% of col. 2 (details see Table 3)*		*Number*	*% of col. 2*	*Number*	*% of col. 2*
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
Breast	229	219	96	200	96	97	8	3.5	...	...
Pharynx, Larynx	56	47	84	40	86	95	...	...	1	1.8
Lung	321	200	62	134	77	70	24	7.5	12	3.7
Esophagus	99	81	82	58	86	90	...	...	7	7.1
Stomach	487	351	72	243	77	85	40	8.2	22	4.5
Small intestine	24	7	29	2	29	50	12	50.0	...	...
Cecum, Appendix	35	17	49	7	51	71	5	14.3	...	...
Colon	154	109	71	54	75	80	27	17.5	9	5.8
Sigmoid, Sigmoid-Colon	179	129	72	68	76	83	20	11.2	4	2.2
Rectum, Recto-sigmoid	251	220	88	174	89	90	10	4.0	4	1.6
Pancreas	171	98	57	43	60	79	6	3.5	14	8.2
Brain	253	77	30	26	91	31	17	6.7	18	7.1
Liver	50	13	26	1	66	44	2	4.0	6	12.0
Gallbladder	71	35	49	9	55	87	3	4.2	5	7.1
Bile ducts	60	22	37	1	53	70	3	5.0	...	...
Kidney	83	46	55	22	68	64	18	21.7	3	3.6
Urinary Bladder	144	112	78	66	81	85	5	3.5	7	4.9
Prostate	129	95	74	61	81	81	38	29.5	1	0.8
Uterus-Corpus	66	43	65	30	71	77	6	9.1	3	4.5
Cervix	80	69	86	60	86	95	6	7.5	2	2.5
Ovaries	114	80	70	51	75	86	5	4.4	1	0.9
Thyroid	25	19	76	16	80	84	4	16.0	2	8.0
Bones	68	48	71	23	74	75	1	1.5	2	2.9
Lymphnodes (Lymphosar-comatosis)	69	39	58	26	70	65	1	1.4	2	2.9
Other sites	244	133	55	81	65	68	20	8.2	23	9.4
Total	3,462	2,311	67	1,496	77	77	271	7.8	148	4.3

different expressions of relative diagnostic accuracy, with all possible combinations. As shown in Table 1 we have topographically and etiologically correct, partly correct, and incorrect diagnoses; basing the decision upon autopsy findings and considering whether or not the clinical diagnosis was correct, partly correct, or incorrect. The partly correct diagnoses of malignancies are divided into those where the site of extension of tumor or site of metastasis was incorrectly given for the primary site and those in which inaccurate terms were used, as where the site of malignancy was given only generally as body region or cavity (abdomen, intestinal, etc.). On etiologic classification we divide the partly correct diagnoses into those where another form of malignancy was mistaken for the correct form of tumor (carcinoma versus sarcoma, etc.) or those where the form of tumor was inaccurately described by "malignancy" or "tumor" of ..... which sometimes indicates exclusively a distinct form of tumor and sometimes permits of two or more alternatives. The incorrect diagnoses were both, etiologic and topographic, divided into incorrect but definite diagnoses and cases where no site or cause was given or only a general symptom was mentioned (obstruction, etc.).

Among 3,462 cases of malignant tumors we find 2,311, or two-thirds, correct in both ways, 2,672, or 77 per cent, etiologically correct, and about as many, 2,664, topographically correct. We see that 145 plus 26 cases were etiologically correct but topographically only partly correct, and on the other hand 37 plus 174 cases topographically correct but etiologically partly correct; and that 9 plus 7 plus 48 plus 31 were partly correct under each category. The total of diagnoses considered as partly correct in one or both ways, but in no way completely incorrect is then 477, or 14 per cent. Those diagnoses incorrect under each category numbered 113 plus 28 plus 16 plus 41 cases, totalling 198, or 6 per cent. We must consider as incorrect also those 476 cases which were so either on account of topographic or etiologic error.

By arranging clinical diagnoses by anatomical site in order of per cent of correct diagnoses, we find that the number of entirely correct diagnoses decreases from 96 per cent (breast tumors) to 26 per cent (liver tumors). We always find a high per cent of accuracy in those diseases which can be recognized easily or give marked and characteristic symptoms. An 80 per cent accuracy or more is found for malignant tumors of breast, rectum (including recto-sigmoid), cervix, pharynx and larynx, esophagus. At the other end of the list we find less than 50 per cent correct diagnoses for malignant growths of the liver, small intestine, brain, and bile duct. Since we have recorded in our abstracts also the diagnoses on admission to the hospital we can count the number of cases in which both diagnoses, the admission and final clinical, were correct. This occurred in 1,496 cases, or 43 per cent, chiefly in cases where there had been readmission for the same diseases, from which conditions after previous operations became worse again. The range of such correct diagnoses at both admission and at death is from 87 per cent (breast) to less than 2 per cent (bile ducts) and demonstrates the difficulty of early diagnosis of some deep-seated malignant neoplasms. Details can be seen in Table 2, column 5.

When we compare the ratio between percentages of topographic and etiologic accuracy in the diagnoses of malignant tumors we find for some organs similar percentages, breast (96 and 97 per cent), rectum (89 and 90 per cent), prostate (both 81 per cent), and in other organs the topographic or etiological diagnosis

less correct, as in small intestine 29 per cent topographically, 50 per cent etiologically, and in bile ducts 53 per cent and 70 per cent respectively, while malignant tumors of brain and liver show the reverse conditions with higher accuracy in topographic diagnosis 91 per cent to 31 per cent, and 66 per cent to 44 per cent respectively.

The usual cause-specific mortality statistics apply to only one primary cause, neglecting all contributory conditions. We have concern to know the total frequency of deaths related to a particular disease, disregarding the difference between primary and contributory causes of death. In cases where a malignant neoplasm occurs coincidentally with another disease, preference is usually given in registration practice to the neoplasm. We followed the same rule in our study. But often there are found at autopsy very small early neoplasms which cannot be properly considered as a primary cause of death because they have caused no pathologic symptoms. The ratio of those contributory malignant growths to the primary cause of death depends upon the speed of growth and upon the symptoms which such small neoplasms make.

We find high percentages of clinically undiscovered neoplasms in the intestine, especially the small intestine, in the prostate, kidney, and thyroid, while bones, lymph nodes, esophagus, pharynx and larynx seldom show a clinically undiscovered neoplasm. This is, so far as bones are concerned, partly due to the limitations of profitable clinical examination.

The discussion of accuracy of malignant tumors would not be complete if we did not mention those cases where a malignant neoplasm (or an unspecified tumor) was clinically diagnosed, which by autopsy was proved to be another and non-malignant disease. In 148 instances such incorrect statement was made, relatively most frequently with regard to the liver, pancreas, thyroid, and esophagus. Eighteen times a malignant tumor of the liver with precise

TABLE 3

Malignant Tumors of 18 Most Frequent Sites With and Without Metastases

Primary site of malignancy	*Malignant tumors of 18 most frequent primary sites*							
		Without metastases		*With metastases*		*Number of metastases found with tumors of col. 4*		
	Total	*No.*	*in % of col. 2*	*No.*	*in % of col. 2*	*Number*	*in % of col. 2*	*in % of col. 5*
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
Stomach	476	130	27.3	346	72.7	1,109	233.0	320.5
Lung	325	63	19.4	262	80.6	941	289.6	359.2
Rectum	239	114	47.7	125	52.3	358	149.8	286.4
Breast	227	20	8.8	207	91.2	1,133	499.1	547.3
Sigmoid	199	92	46.2	107	53.8	254	127.7	237.3
Pancreas	176	52	29.5	124	70.5	367	208.5	296.0
Bladder	148	102	68.9	46	31.1	108	73.0	234.8
Colon	146	86	58.9	60	41.1	187	128.1	311.6
Prostate	120	39	32.5	81	67.5	253	210.8	312.3
Ovaries	115	12	10.4	103	89.6	433	376.4	420.7
Esophagus	101	38	37.6	63	62.4	105	104.0	166.6
Kidney	92	14	15.2	78	84.8	308	334.9	395.0
Cervix	75	36	48.0	39	52.0	103	137.3	264.1
Gallbladder	69	24	34.8	45	65.2	176	255.1	391.0
Bile ducts	63	28	44.5	35	55.5	86	136.5	245.7
Uterus-Corpus	59	20	33.9	39	66.1	149	252.4	382.0
Pharynx-Larynx	57	39	68.4	18	31.6	43	59.7	238.9
Liver	49	12	24.5	37	75.5	116	236.8	313.6
Total 18 most frequent sites	2,736	921	33.7	1,815	66.3	6,129	224.2	337.9

or inaccurate etiologic cause stated, was clinically correctly diagnosed, and six times such a neoplasm was incorrectly stated. In column 10 of Table 2 we present the number of cases (148) diagnosed at autopsy with the primary causes of death other than malignant tumor.

The complete statistics of primary and secondary (or contributory) factors causing death enable us to judge the prevalence of metastases with respect to primary sites. Some malignant neoplasms tend to spread easily and some do not.

We deal in our autopsy statistics only with those cases of cancer that died from that disease. We do not have, therefore, those cases of breast carcinoma where early cases were successfully treated, such being mostly cases without metastases. As we find that 91 per cent of breast cancer cases had metastases (in our series), we may conclude that breast cancer was fatal in few cases having no metastases. But besides the breast we find an interesting series of other organs, according to frequency of metastases, beginning with ovaries (90 per cent cases with metastases) and ending with bladder (31 per cent with metastases). We find relatively most metastases with malignant tumors of the breast, ovaries, kidney, gall bladder, and uterus, and few with such neoplasms of the esophagus, pharynx, larynx, bladder, sigmoid, and bile ducts. On the average we have for the 18 most frequent original sites of malignant tumors one-third of the cases without, and two-thirds with metastases, and there are about three and one-third per case having metastases.

In Table 4 there are tabulated 6,129 metastatic neoplasms by 37 categories of site related to the occurrence of death attributed to one of 18 primary sites of the neoplasm in 2,736 cases. (We should mention here that the difference between the total number of deaths due to primary neoplasms of various sites in Table 3 and 4 (column 2) is due to those cases omitted in either study for which there was incomplete data for the one or other item).

We have calculated the ratios of metastastic frequencies to each 100 cases of primary tumors. We find lymph nodes reported as affected by metastases in 42 per cent of all primary sites together, liver metastases in 34 per cent, and lung metastases in 21 per cent. Next in frequency of involvement come peritoneum, 16 per cent, adrenal and pleura 11 per cent. All other sites are involved in less than 10 per cent of the cases.

When we now compare the ratios for the specified primary sites with the corresponding ratios for all primary sites together, we get an expression of the relationship between primary and secondary sites of malignant neoplasms. In Table 5 we have the result of such comparison (quotients of specified site through total of sites). Coefficients higher than one indicate a higher frequency than would be expected by rule of chance, and lower than one indicates a smaller frequency than expected.

We must take into account that often the numbers of cases involved are small and give rise to a considerable statistical error.

We note that primary carcinoma of the stomach tends rarely to metastasize in the breast, but that primary malignant breast neoplasms tend more commonly to metastasize in the stomach; that primary carcinoma of the lung relatively frequently develops metastases of the pharynx and larynx. The only metastases developing in the rectum with over-average frequency are those following primary carcinoma of the prostate. In a complete list every combination of two organs is listed twice, each of both organs being once a primary and once a secondary site. While primary

TABLE 4

(Continued opposite page)

Site of Metastases with 18 Most Frequent Malignant Tumors

Site of Primary Malignancy	Number of Malignant Tumors According to Primary Site	Site of Metastases: Lymph Nodes	Skin	Breast	Pharynx, Larynx	Lung	Esophagus	Stomach	Small Intestine	Colon	Sigmoid	Rectum	Cecum, Appendix	Brain	Liver	Gallbladder	Bile Ducts	Pancreas	Kidney	Bladder
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Stomach	476	269	3	1	..	72	..	1	21	14	4	1	7	1	192	18	10	55	29	6
Lung	325	186	8	..	28	59	5	4	18	1	1	1	..	30	101	4	1	24	47	1
Rectum	239	61	5	..	..	47	..	1	6	2	..	1	..	3	85	5	2	8	9	4
Breast	227	135	35	26	..	128	3	13	10	2	2	2	..	34	127	4	1	22	31	2
Sigmoid	199	50	..	..	..	25	..	3	8	2	..	2	2	..	61	1	6	1	1	3
Pancreas	176	64	2	..	..	32	1	9	11	6	1	1	..	..	88	7	6	2	9	..
Bladder	148	30	1	..	..	11	..	..	1	2	..	..	1	1	18	2	..	2	5	..
Colon	146	37	1	..	2	11	..	3	7	..	1	3	1	..	38	2	2	7	4	2
Prostate	120	64	2	..	1	29	1	2	3	1	1	1	1	2	11	..	1	1	4	4
Ovaries	115	56	2	..	1	21	..	4	20	7	1	2	1	3	44	8	1	11	13	6
Esophagus	101	45	..	..	1	15	..	3	..	..	..	..	..	..	19	..	..	..	1	..
Kidney	92	45	4	..	1	54	..	..	5	2	1	..	1	6	28	..	..	5	26	1
Cervix	75	24	..	..	..	14	..	..	2	2	1	2	2	1	7	..	..	..	2	5
Gallbladder	69	31	..	..	..	9	3	5	4	1	..	..	..	1	42	..	2	6	2	2
Bile ducts	63	19	1	..	..	9	..	2	3	1	..	..	1	..	18	4	..	3	..	..
Uterus, Corpus	59	18	..	..	..	23	..	..	2	2	2	1	1	..	22	1	1	2	4	3
Pharynx, Larynx	57	14	..	..	..	5	1	..	..	..	..	..	..	..	3	1	..	1	2	..
Liver	49	22	2	..	..	24	1	3	1	1	..	..	..	1	4	2	..	8	7	..
Total 18 most frequent sites	2,736	1,156	66	27	34	588	14	53	122	46	15	17	18	83	903	59	33	158	196	39

TABLE 5

(Continued opposite page)

Coefficients of Pathologic Relation Between Site of Origin and Site of Metastases with Malignant Tumors

Site of Primary Malignancy	Coefficients of Pathologic Relation for Site of Metastasis: Lymph Nodes	Skin	Breast	Pharynx, Larynx	Lung	Esophagus	Stomach	Small Intestine	Colon	Sigmoid	Rectum	Cecum, Appendix	Brain	Liver	Gallbladder	Bile Ducts	Pancreas	Kidney	Bladder
1–2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Stomach	1.3	0.3	0.2	0	0.7	0	0.1	1.0	1.7	1.5	0.3	2.3	0.1	1.2	1.7	1.7	2.0	0.8	0.9
Lung	1.4	1.0	0	7.2	0.9	2.9	0.6	1.2	0.2	0.6	0.5	0	3.1	0.9	0.5	0.3	1.3	2.0	0.2
Rectum	0.6	0.9	0	0	0.9	0	0.2	0.6	0.5	0	0.7	0	0.4	1.1	1.0	0.7	0.6	0.5	1.2
Breast	1.4	6.4	11.6	0	2.6	2.6	3.0	1.0	0.5	1.6	1.4	0	5.0	1.7	0.8	0.4	1.7	1.9	0.6
Sigmoid	0.6	0	0	0	0.6	0	0.8	0.9	0.6	0	1.6	1.7	0	0.9	0.2	2.5	0.1	0.1	1.1
Pancreas	0.8	0.5	0	0	0.9	1.1	2.7	1.4	2.0	1.0	0.9	0	0	1.5	1.8	2.8	0.2	0.7	0
Bladder	0.5	0.3	0	0	0.3	0	0	0.2	0.8	0	0	1.0	0.2	0.4	0.6	0	0.2	0.5	0
Colon	0.6	0.3	0	1.2	0.3	0	1.1	1.1	0	1.3	3.4	1.0	0	0.8	0.6	1.2	0.8	0.4	1.0
Prostate	1.3	0.7	0	0.7	1.1	1.6	0.9	0.6	0.5	1.5	1.3	1.3	0.6	0.3	0	0.7	0.1	0.5	2.4
Ovaries	1.1	0.7	0	0.7	0.9	0	1.8	3.9	3.6	1.6	2.7	1.3	0.9	1.1	3.2	0.7	1.7	1.6	3.7
Esophagus	1.0	0	0	0.8	0.7	0	1.6	0	0	0	0	0	0	0.6	0	0	0	0.1	0
Kidney	1.2	1.8	0	0.9	2.8	0	0	1.2	1.3	2.0	0	1.9	2.2	0.9	0	0	0.9	3.9	0.8
Cervix	0.8	0	0	0	0.9	0	0	0.6	1.6	2.4	4.4	4.1	0.4	0.3	0	0	0	0.4	4.8
Gallbladder	1.1	0	0	0	0.6	8.4	3.8	1.3	0.8	0	0	0	0.5	2.0	0	2.4	1.5	0.4	2.1
Bile ducts	0.7	0.7	0	0	0.7	0	1.7	1.1	0.9	0	0	2.4	0	0.8	2.9	0	0.8	0	0
Uterus–Corpus	0.7	0	0	0	1.8	0	0	0.8	2.0	6.2	2.7	2.6	0	1.2	0.8	1.4	0.6	0.9	3.6
Pharynx–Larynx	0.6	0	0	0	0.4	3.4	0	0	0	0	0	0	0	0.2	0.8	0	0.3	0.5	0
Liver	1.1	1.7	0	0	2.3	3.9	3.2	0.4	1.2	0	0	0	0.7	0.2	1.9	0	2.8	2.0	0
Total 18 most frequent sites	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

TABLE 4 *(Continued)*

Site of Metastases with 18 Most Frequent Malignant Tumors

Site of Primary Malignancy	Number of Malignant Tumors According to Primary Site	Site of Metastases: Prostate	Uterus	Cervix	Ovaries	Adrenals	Thyroid	Mediastinum	Pleura	Pericardium	Heart	Vertebrae	Other Bones	Spleen	Peritoneum	Mesenterium	Omentum	Diaphragm	Other Sites	Total Metastases All Organs
1	2	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Stomach	476	1	10	..	28	29	2	4	33	4	6	13	16	22	101	26	68	27	15	1,109
Lung	325	1	1	..	8	89	9	9	58	27	23	36	76	28	15	2	2	18	20	941
Rectum	239	5	3	1	4	19	3	1	9	2	1	15	11	3	14	6	2	4	17	358
Breast	227	..	13	..	33	75	11	9	97	23	10	47	64	26	87	10	9	20	22	1,133
Sigmoid	199	..	4	1	13	7	..	..	1	..	..	6	7	2	20	6	10	3	9	254
Pancreas	176	..	..	..	8	16	..	1	7	1	2	4	5	6	39	8	10	12	10	367
Bladder	148	..	1	1	2	3	..	1	1	..	3	1	4	1	3	..	1	1	11	108
Colon	146	1	5	1	8	5	..	1	3	2	2	1	1	5	12	7	5	3	4	187
Prostate	120	..	..	..	..	9	1	1	8	2	1	23	38	4	4	3	2	1	27	253
Ovaries	115	..	15	1	5	10	2	1	22	3	2	3	6	22	73	12	22	18	15	433
Esophagus	101	..	..	..	2	4	1	..	5	2	..	1	1	..	2	1	..	1	1	105
Kidney	92	2	2	1	1	25	5	1	12	1	11	11	19	4	12	2	2	7	11	308
Cervix	75	..	4	..	1	2	..	1	6	1	1	4	3	2	3	..	5	1	7	103
Gallbladder	69	..	2	..	6	4	1	..	10	1	1	1	3	1	16	6	10	5	2	176
Bile ducts	63	..	..	..	3	2	..	..	2	..	1	..	2	1	7	1	2	3	1	86
Uterus, Corpus	59	..	..	..	4	4	..	1	7	1	1	3	5	3	16	4	3	4	12	149
Pharynx, Larynx	57	..	..	..	..	4	1	..	3	2	..	1	3	..	..	1	..	..	1	43
Liver	49	..	..	..	..	4	2	..	7	..	1	..	3	4	6	3	1	6	3	116
Total 18 most frequent sites	2,736	10	57	6	126	311	38	31	291	72	66	170	267	134	430	97	154	134	188	6,129

TABLE 5 *(Continued)*

Coefficients of Pathologic Relation Between Site of Origin and Site of Metastases with Malignant Tumors

Site of Primary Malignancy	Coefficients of Pathologic Relation for Site of Metastasis: Prostate	Uterus	Cervix	Ovaries	Adrenal	Thyroid	Mediastinum	Pleura	Pericardium	Heart	Vertebrae	Other bones	Spleen	Peritoneum	Mesenterium	Omentum	Diaphragm	Other sites
1–2	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
Stomach	0.6	1.0	0	1.3	0.5	0.3	0.8	0.7	0.3	0.5	0.4	0.3	0.9	1.4	1.6	2.6	1.2	0.5
Lung	0.8	1.0	0	0.5	2.4	2.0	2.5	1.7	3.2	3.0	1.8	2.4	1.8	0.3	0.2	0.1	1.1	0.9
Rectum	5.7	0.6	2.0	0.3	0.7	0.9	0.4	0.4	0.3	0.2	1.0	0.5	0.3	0.4	0.7	0.2	0.3	1.0
Breast	0	2.7	0	3.2	2.9	3.4	3.6	4.0	3.9	1.8	3.3	2.9	2.3	2.4	1.3	0.7	1.8	1.4
Sigmoid	0	1.0	2.4	1.4	0.3	0	0	0.1	0	0	0.5	0.4	0.2	0.6	0.9	0.9	0.3	0.7
Pancreas	0	0	0	1.0	0.8	0	0.5	0.4	0.2	0.5	0.4	0.3	0.7	1.4	1.3	1.1	1.4	0.8
Bladder	0	0.3	3.2	0.2	0.3	0	0.6	0.1	0	0.8	0.1	0.3	0.1	0.1	0	0.1	0.1	1.1
Colon	1.9	1.6	3.3	1.2	0.3	0	0.6	0.2	0.5	0.6	0.1	0.1	0.7	0.5	1.4	0.6	0.4	0.4
Prostate	0	0	0	0	0.7	0.6	0.8	0.6	0.7	0.3	3.1	3.2	0.7	0.2	0.7	0.3	0.2	3.3
Ovaries	0	6.2	4.1	0.9	0.8	1.2	0.8	1.8	1.0	0.7	0.4	0.5	3.9	4.0	3.0	3.5	3.2	1.9
Esophagus	0	0	0	0.4	0.4	0.7	0	0.5	0.8	0	0.2	0.1	0	0.1	0.3	0	0.2	0.1
Kidney	5.9	1.0	5.2	0.2	2.4	3.8	1.0	1.2	0.4	5.0	1.9	2.1	0.9	0.8	0.6	0.4	1.6	1.7
Cervix	0	2.5	0	0.3	0.2	0	1.2	0.8	1.5	0.5	0.9	0.4	0.6	0.3	0	1.2	0.3	1.3
Gallbladder	0	1.4	0	1.9	0.5	1.0	0	1.4	1.5	0.6	0.2	0.4	0.3	1.5	2.5	2.7	1.5	0.4
Bile ducts	0	0	0	1.0	0.3	0	0	0.3	0	0.7	0	0.3	0.3	0.7	1.5	0.6	1.0	0.2
Uterus–Corpus	0	0	0	1.5	0.6	0	1.5	1.1	0.7	0.7	0.8	0.9	1.0	1.7	1.9	0.9	1.4	2.9
Pharynx–Larynx	0	0	0	0	0.6	1.2	0	0.5	1.3	0	0.3	0.5	0	0	0.5	0	0	0.3
Liver	0	0	0	0	0.7	2.9	0	1.4	0	0.8	0	0.6	1.7	0.8	1.7	0.4	2.5	0.9
Total 18 most frequent sites	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

carcinoma of the esophagus does not tend to metastasize in the gall bladder, we find that the esophagus as site of secondary neoplasms receives its metastases relatively more frequently from primary neoplasms of the gall bladder than from other sites. The highest relation between two organs in our list (Table 5) is that between both single breasts. It must be understood that statistically adequate ratios must await the use of a larger series of case histories for malignant neoplasms in relatively rare sites, both primary and secondary.

It will be obvious that the above analysis of the deaths due to cancer is of value chiefly at this stage as a test of the method of study and its usefulness in supplying us with some approach to desirable criteria or mathematical indices of error to be expected and to be allowed for when preparing specific cause-mortality rates, based upon clinical diagnoses of varying degrees of inaccuracy or incompleteness.

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Relative Toxicity of Certain Antiseptics Containing Soap and Alcohol

With Special Reference to Mouth Washes *

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IN 1939 a method was presented [1] for the evaluation of germicidal compounds in which the toxicity of such substances for a circulating tissue (human or guinea pig blood) was compared with the toxicity of these compounds for a standard strain † of *Staphylococcus aureus*. A toxicity index was computed by dividing the greatest dilution of the compound under test toxic for tissue by the greatest dilution capable of killing the test organism. The mechanism of the toxic action of germicides on whole blood used as a tissue measured by the loss of the phagocytic activity of leucocytes and the use of hemolytic complement to determine the toxic effect were subsequently studied.[2, 3] Our results showed that although some indication of the toxic effect of germicides could be determined by observation of hemolysis, or coagulation, or by measuring the destruction of hemolytic complement, utilization of the phagocytic function of the leucocyte as an index of toxicity gave the most exact and consistent results. Germicides tested with this method by different technicians consistently have shown the same "toxic endpoint" and no variations in these endpoints are observed when different human bloods or different guinea pig bloods are used in the test. A ready reference of the toxic effect of the compounds studied is possible since permanent blood smears may be prepared and kept on file.

In addition to the technical advantages of the proposed method, the use of blood, a tissue which is uniform in its makeup and reaction, to determine the toxic action of germicides approaches the actual conditions of use of these substances in or on the human body more nearly than other tissue methods and, further, the use of the phagocytic function of the leucocyte as an indication of the toxic action of these compounds appears especially appropriate since the purpose of antiseptic substances is to augment rather than retard the natural defenses of the host. In a recent publication, Fleming [4] points out that "In a septic wound in which the infection had become established, the pus had considerable antibacterial power which were lost when the cells were killed by heat, drying or by treatment with antiseptics." He further states that "Any chemical which was more destructive to leucocytes than it was to bacteria was very unlikely to be effective as a direct antiseptic in a septic wound."

In studying a group of compounds insoluble in water, the appreciable tox-

* Read before the Laboratory Section of the American Public Health Association at the Seventieth Annual Meeting in Atlantic City, N. J., October 14, 1941.

† This strain of *Staphylococcus aureus* has a standard resistance to phenol maintained for testing germicidal substances in the Food and Drug Administration, Washington, D. C.

icity of alcohol used as solvent and the marked toxicity of soap solution, used as an emulsifying agent, attracted attention. After obtaining toxicity indices on alcohol and castile soap, the influence of these substances on the toxicity and germicidal action of phenol was investigated. Solutions of phenol dissolved in 50 per cent alcohol and in 5 per cent castile soap solution were used as a dilution basis.

The toxicity of an aqueous solution of phenol for guinea pig tissue has been demonstrated [1] to be 1:500. When 5 per cent phenol is mixed with an equal amount of alcohol before dilution, its toxicity is markedly increased to 1:1,800 and in 5 per cent soap solution the toxicity is further greatly increased to 1:6,500. Correspondingly, the toxicity index increases from 5.0 (phenol in water) to 9.0 (phenol in alcohol) to 43.3 (phenol in soap solution). These results are shown in Table 1. Although the bactericidal dilution of aqueous phenol is 1:100 under the conditions of this test, a 1:200 dilution of an alcoholic solution of phenol is germicidal, and while the use of soap solution as a solvent for phenol increases the toxicity greatly over that of phenol in alcohol, there is not a corresponding increase in germicidal efficiency. On the contrary, the germicidal power is decreased by 25 per cent under that shown by phenol in alcohol.

In testing some essential oils and other compounds insoluble in water, a similar phenomenon was noted (Table 1). Those oils dissolved in alcohol (50 per cent or 100 per cent, depending on the solubility of the oil) were considerably less toxic than when emulsified in 5 per cent soap solution. Perhaps the most striking example is that of thymol which is toxic for tissue in a dilution of 1:2,500 when dissolved in alcohol (50 per cent), while emulsified in 5 per cent soap solution it is toxic in a dilution of 1:18,000. The toxicity indices are correspondingly widely divergent, since an index of 1.3 is obtained with thymol in alcohol and 45.0 with thymol in soap solution. Chlorothymol also shows a similar phenomenon. An excellent index of 0.83 is obtained when this substance is dissolved in alcohol, while a marked increase to 20.0 is found when soap solution is used as carrying agent. It should be noted that since the concentrations of alcohol and soap are also diminished on dilution, the concentration of alcohol at the toxic endpoint of

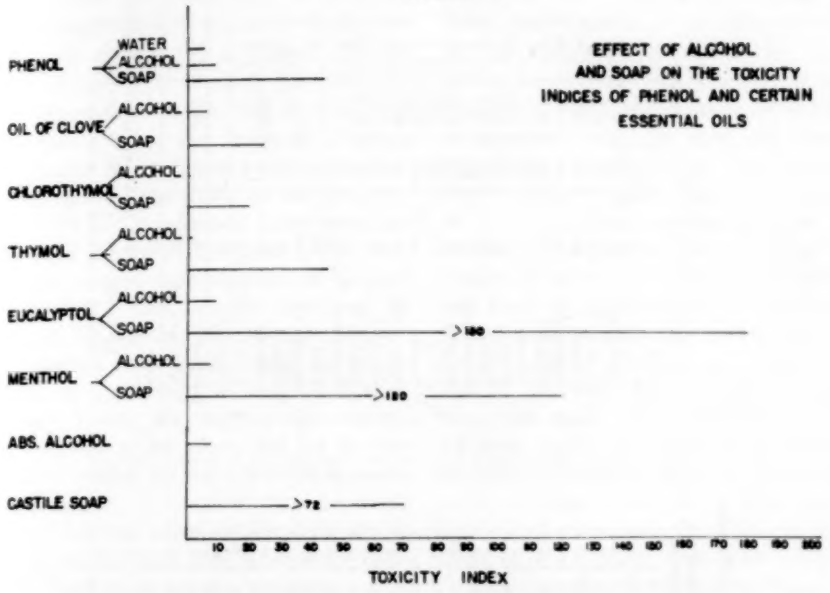
TABLE 1

Relative Toxicity and Toxicity Indices of Certain Germicidal Substances Containing Soap or Alcohol

		Tissue Toxicity		*Toxicity for Staphylococci*		
Compound	*Solvent*	*Toxic Endpoint*	*% Alcohol or Soap*	*Germicidal Dilution*	*% Alcohol or Soap*	*Toxicity Index*
Phenol	Water	1:500	..	1:100	..	5.0
Phenol	Alcohol	1:1,800	2.7	1:200	10.0	9.0
Phenol	Soap	1:6,500	0.08	1:150	1.3	43.3
Oil of Clove	Alcohol	1:2,000	2.5	1:300	6.6	6.6
Oil of Clove	Soap	1:2,500	0.04	1:100	1.0	25.0
Chlorothymol	Alcohol	1:2,500	2.0	1:3,000	1.7	0.83
Chlorothymol	Soap	1:10,000	0.05	1:500	1.0	20.0
Thymol	Alcohol	1:2,500	2.0	1:2,000	2.5	1.3
Thymol	Soap	1:18,000	0.03	1:400	1.3	45.0
Eucalyptol	Alcohol	1:1,400	3.6	1:150	13.3	9.3
Eucalyptol	Soap	1:4,500	0.02	1:25*	4.0	>180
Menthol	Alcohol	1:1,500	3.3	1:200	10.0	7.5
Menthol	Soap	1:3,000	0.03	1:25*	4.0	>120
Abs. alcohol		1:30	..	1:4	..	7.5
Castile soap		1:1,800	..	1:25*	..	>72

* Not germicidal at dilution indicated

CHART I



thymol was 2 per cent and the concentration of soap only 0.03 per cent. In Table 1 it will be observed that all the substances tested showed a marked increase in toxicity for tissue and a definite decrease in germicidal activity when alcohol was replaced by soap as a solvent. For comparative purposes, the toxicity indices of absolute alcohol and the castile soap used in these studies were determined. It will be observed that absolute alcohol is toxic for tissue at 1:30 and germicidal at 1:4, while castile soap is toxic at 1:1,800 and is *not* germicidal at 1:25. The toxicity index of alcohol is 7.5, while that of soap is greater than 72. The differences in toxicity indices, depending on the use of alcohol or soap as a solvent, are shown graphically in Chart 1.

The results presented in Table 1 and illustrated in Chart 1 reveal that the toxicity of the principal substance in an antiseptic solution may be of very minor importance and that of the menstruum may assume the rôle of primary importance. For example, the toxicity of phenol determined in aqueous solution offers no clue to its toxicity in the presence of even small amounts of alcohol or soap. To a lesser degree the same is true of its germicidal properties; but, as has been pointed out, the two effects are not proportional. It is quite obvious that a substance found to have a comparatively favorable toxicity index may have a relatively unfavorable index in a different menstruum or upon the addition of even small amounts of other substances.

It was demonstrated in a previous paper that a slight increase in the concentration of table salt increased the toxicity of phenol. Thus in the case of the compounds listed in Table 1 which are not soluble in water, the toxicity of the basic substance has not been measured but only that of a combination of substances from which it is not possible to deduce the toxic qualities of the individual components. It should be remembered that the figures given for toxicity are not those dilu-

TABLE 2

Toxicity Indices of 87 Mouthwashes

Mouthwash	*% Alcohol*	*Tissue Toxicity*	*Toxicity for Staph.*	*Index*
Adde	25	1:5	N.G. 1:2.5	>2
Amber	30	1:5	N.G. 1:2.5	>2
Aseptisol	25	1:5	N.G. 1:2.5	>2
Baffaline	10	1:5	N.G. 1:2.5	>2
Benaco	25	1:5	N.G. 1:2.5	>2
Boggs & Buhl	30	1:5	N.G. 1:2.5	>2
Borolene	25	1:5	N.G. 1:2.5	>2
Calox	30	1:5	N.G. 1:2.5	>2
C.B.L.	0	1:5	N.G. 1:2.5	>2
Camp Enol †	0	1:5	N.G. 1:2.5	>2
Caulk Mercitan	8	1:5	N.G. 1:2.5	>2
Chappelle	25	1:5	N.G. 1:2.5	>2
Chartex	5.6	1:5	N.G. 1:2.5	>2
Cheney's	25	1:5	N.G. 1:2.5	>2
Connor's	26	1:5	N.G. 1:2.5	>2
Courtier	25	1:5	N.G. 1:2.5	>2
Druco	26	1:5	N.G. 1:2.5	>2
Five Star *	0	1:5	N.G. 1:2.5	>2
Forhan's	10	1:5	N.G. 1:2.5	>2
H.A.S. Solution	25	1:5	N.G. 1:2.5	>2
Hospital	25	1:5	N.G. 1:2.5	>2
Iodoseptic †	0	1:5	N.G. 1:2.5	>2
Jamieson's	25	1:5	N.G. 1:2.5	>2
Kent	28	1:5	N.G. 1:2.5	>2
Kojene	0	1:5	N.G. 1:2.5	>2
La Cross	25	1:5	N.G. 1:2.5	>2
Laymon's	25	1:5	N.G. 1:2.5	>2
Listerine	25	1:5	N.G. 1:2.5	>2
Marlo	25	1:5	N.G. 1:2.5	>2
Met-O-Sol	14	1:5	N.G. 1:2.5	>2
Mi-31	25	1:5	N.G. 1:2.5	>2
Mifflin	25	1:5	N.G. 1:2.5	>2
Minard's	28	1:5	N.G. 1:2.5	>2
Nurse Brand	28	1:5	N.G. 1:2.5	>2
Nyseptol	28	1:5	N.G. 1:2.5	>2
Parker's Brand	25	1:5	N.G. 1:2.5	>2
Park's	28	1:5	N.G. 1:2.5	>2
Pasteur's	30	1:5	N.G. 1:2.5	>2
Peerless	26	1:5	N.G. 1:2.5	>2
Pepsodent	26	1:5	N.G. 1:2.5	>2
Prescott's	30	1:5	N.G. 1:2.5	>2
Purepac	28	1:5	N.G. 1:2.5	>2
Puritan	25	1:5	N.G. 1:2.5	>2
Rel-Ka-Sol	12	1:5	N.G. 1:2.5	>2
Rx-37	25	1:5	N.G. 1:2.5	>2
Rx-59	25	1:5	N.G. 1:2.5	>2
Sago	28	1:5	N.G. 1:2.5	>2
Sanalin	28	1:5	N.G. 1:2.5	>2
Sanative	28	1:5	N.G. 1:2.5	>2
Sandford's	0	1:5	N.G. 1:2.5	>2
Septisan	25	1:5	N.G. 1:2.5	>2
Silverfine	25	1:5	N.G. 1:2.5	>2
S.T. 37	0	1:5	N.G. 1:2.5	>2
Steven's	28	1:5	N.G. 1:2.5	>2
Stomaseptine *	0	1:5	N.G. 1:2.5	>2
Thorol	25	1:5	N.G. 1:2.5	>2
United Whelan	28	1:5	N.G. 1:2.5	>2
Vick's	25	1:5	N.G. 1:2.5	>2
Wampole's Bon.	15	1:5	N.G. 1:2.5	>2
Wampole's For.	15	1:5	N.G. 1:2.5	>2
York	30	1:5	N.G. 1:2.5	>2
Z-L	25	1:5	N.G. 1:2.5	>2
Antiseptine	25	1:10	N.G. 1:2.5	>4
Arco	30	1:10	N.G. 1:2.5	>4
Cepacol	18	1:10	N.G. 1:2.5	>4
Dentiseptine	6	1:10	N.G. 1:2.5	>4
Hydrosol	0	1:10	N.G. 1:2.5	>4
Jermene	0	1:10	1:5	2
Kleenzo	25	1:10	N.G. 1:2.5	>4
Pameco	20	1:10	N.G. 1:2.5	>4
Pentacresol	30	1:10	1:2.5	4
Reliance	26	1:10	N.G. 1:2.5	>4
S.K.F.	28	1:10	N.G. 1:2.5	>4
Squibb	26–29	1:10	N.G. 1:2.5	>4
White Cross	25	1:10	N.G. 1:2.5	>4
Zhongiva	36	1:10	N.G. 1:2.5	>4
Borolyptol	8	1:15	N.G. 1:2.5	>6
Waites Anti-Pyo	25	1:15	N.G. 1:2.5	>6
Extol	50	1:20	1:2.5	8
Hychlorite	0	1:20	1:10	2
Mark 4	60	1:20	1:10	2
Salzinco	25	1:20	N.G. 1:2.5	>8
Zonite	0	1:20	1:7.5	2.7
Fo-Fen-x	88.5	1:25	1:5	5
Gilbert's	0	1:30	N.G. 1:2.5	>12
Astring-O-Sol	70	1:40	1:5	8
Afko	70	1:50	1:5	10

NOTE: N.G.=not germicidal at dilution given
* In powder form, prepared as directed
† Diluted as directed for mouthwash

tions which are sufficiently toxic to reduce phagocytosis but those which prevent all phagocytic activity. In the case of phenol in alcohol, for example, the percentage of alcohol in the final dilution is below the range of absolute toxicity of this substance but not necessarily beyond the limits of all toxicity; and it is not possible to judge whether the toxic endpoint obtained is due primarily to this concentration of alcohol augmented with small amounts of phenol, or whether the reverse is true, or whether the explanation is to be found in a mutually synergistic action. In any event, the increase in toxicity is too great to be accounted for by the additive effect of the two compounds taken singly. It is known that bacterial spores are not killed by alcohol, yet it has been shown in this laboratory (unpublished) that in the presence of a definite percentage of alcohol 5 per cent hydrochloric acid becomes as sporicidal as a 20 per cent aqueous solution of hydrochloric acid. Decreases or increases in the percentage of alcohol give a decreased efficiency. Cade [5] has shown that the germicidal action of phenol and certain related compounds can be greatly increased by the addition of the proper amounts of soap, and that the optimal amount varies not only with type of soap but with the compound to which it is added. This being the case with germicidal effect, it is logical to suppose that with the apparently much greater sensitivity of tissue to soap, the critical amount is even more important. No attempt was made to determine those concentrations of soap most affecting the toxicity of the various compounds. It should be stated that in some of the dilutions tested in determining the endpoint, complete solubility was not always obtained.

Inasmuch as essential oils are contained in a great majority of mouthwashes, and alcohol is made use of as a solvent, and since it is common for these preparations to be recommended for use undiluted as well as for application to cuts and scratches or as general antiseptics, it becomes of interest to determine whether they are free of significant toxicity. In the present study toxicity index tests on a group of 87 commercial mouthwashes are included. The results are summarized in Table 2, where the toxicity for tissue and bactericidal power for Staphylococci of 87 mouthwashes are given and the toxicity index of each computed. Of the 87 mouthwashes studied, 62 were toxic for tissue in a dilution of 1:5; 14 were toxic for tissue in a dilution of 1:10; 2 were toxic in a dilution of 1:15; 5 were toxic in a dilution of 1:20, and one each was toxic at dilutions of 1:25, 1:30, 1:40 and 1:50.

None of the mouthwashes toxic at 1:5 was capable of killing the standard strain of *Staphylococcus aureus* (209) under the conditions of this test at a final dilution of 1:2.5. The toxicity index in each case was therefore greater than 2.0. Of those mouthwashes in the group toxic for tissue at 1:10, it was possible to compute accurately the toxicity index of only two, Jermene and Pentacresol. These mouthwashes had indices of 2.0 for the former and 4.0 for the latter, and all others in this group had indices greater than 4.0, since none was germicidal in a dilution of 1:2.5. Neither one of the mouthwashes toxic in a 1:15 dilution was germicidal in a 1:2.5 dilution, and their indices were, therefore, greater than 6.0, while 4 of the 5 toxic for tissue at 1:20 were germicidal under the conditions of this test, one in a dilution of 1:10. In this group, Extol had a computed toxicity index of 8.0, Hychlorite Solution an index of 2.0; Mark 4 an index of 2.0; Zonite an index of 2.7; and Salzinco, which was not germicidal at 1:2.5, had an index greater than 8.0. Of the remaining 4 mouth-

washes in this series, Fo-fen-x, Gilbert's, Astring-o-sol and Afko, "toxic end-points" of 1:25, 1:30, 1:40 and 1:50, respectively, were obtained. All but Gilbert's mouthwash were germicidal at a 1:5 dilution. This mouthwash, being not germicidal at a 1:2.5 dilution, had an index greater than 12, while the toxicity index of Fo-fen-x was 5, that of Astring-o-sol 8, and Afko 10. It should be noted that the toxicity index number represents the number of times the mouthwash is more toxic for tissue than it is for the test organism. It will be remembered that in determining the toxicity index, both tests contain whole blood; the toxicity test 40 per cent, the germicidal only 10 per cent, and that toxicity is measured not at the dilution affecting normal phagocytosis but at the weakest dilution which prevents all phagocytic activity.

It is of interest that of the 76 mouthwashes tabulated and found to be toxic at a 1:5 or 1:10 dilution, 56 of these are *Liquor antisepticus* type, while of the 11 remaining in this series toxic in dilutions from 1:15 to 1:50, only one is definitely this type. Of the 87 mouthwashes tested, only 9 were germicidal under the conditions of the test, and these varied in their indices from 2 to greater than 12. It is quite apparent that those mouthwashes showing definite germicidal power correspondingly showed greater toxicity for tissue. Of the 62 found to be toxic when diluted 1:5, 54 are offered for use undiluted; furthermore, 9 of the 14 found toxic in a 1:10 dilution bear a similar recommendation. Of this group toxic at 1:5 or 1:10, 74 of the 76 so-called antiseptics were unable in 30 minutes to kill all *Staphylococcus aureus* present under the conditions of this test.

COMMENT

In presenting the above data, no thought of discrimination or special examination is connected with any of the preparations used. Indeed, the results amply show that no special credit or discredit can be ascribed to any individual preparation or type of compound. The object in collecting the results is part of a general study of germicidal substances. It is felt that by a comparison of a number of substances tested by different methods and types of methods our knowledge of the effective uses of germicides can gradually be increased.

Although this test possesses considerable practical value, the impossibility of evaluating antiseptics for all their diverse uses by results of this method alone is thoroughly recognized. On the other hand, the results in Table 2 illustrate several generalities perhaps well known but too seldom considered. Not one of the preparations tested approaches the classical conception of an ideal antiseptic. On the contrary, the results demonstrate that if used on cuts, scratches, or open wounds for which purpose many bear recommendations, not only would the majority fail to produce complete germicidal effect but their presence would continue to prevent the normal protective action of the blood after germicidal value was lost. The importance of Fleming's contention, quoted earlier, is emphasized by these figures, which also might well be used to point out the inadvisability and possible harm caused by the indiscriminate use of antiseptics for a variety of conditions and purposes without ample consideration of the results likely to be obtained in a particular condition.

It might be contended that the unfavorable balance between toxicity and germicidal ability of the preparations tested signifies too harsh a test, and that *Staphylococcus aureus,* although comparatively resistant, is by no means the only organism to be combated with

antiseptics. Nevertheless, recognition of *Staphylococcus aureus* as a frequent and sometimes dangerous invader of wounds and of the existence of strains of standardized resistance not only justifies but clearly dictates its use as a test organism for a toxicity method of this kind.

SUMMARY

Using the destruction of phagocytic activity as a measurement of toxicity and comparing toxicity with germicidal ability under a similar set of conditions to obtain a toxicity index, it was found that the addition of alcohol to a solution of phenol increased the toxicity index. A very marked increase in the toxicity index occurred when soap was added to phenol solutions. The relatively high toxicity index caused by the addition of soap was demonstrated with several phenolic compounds and essential oils. The toxicity of alcohol and soap was obtained for comparison. The toxicity and germicidal power of 87 commercial mouthwashes have been determined. Only 9 of the 87 mouthwashes tested were found to be germicidal under the conditions of test, while 62 were toxic in a 1:5 dilution; 14 were toxic in a 1:10 dilution; 2 were toxic in a 1:15 dilution; 5 were toxic in a 1:20 dilution, and one each was toxic at dilutions of 1:25, 1:30, 1:40 and 1:50.

A brief discussion of the application of the toxicity-index method to the evaluation of antiseptics is presented.

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Neighborhood Health

WE note with great reluctance the discontinuance for an indefinite period of *Neighborhood Health*, a publication issued by the Department of Health of the City of New York. The Department is dropping this periodical as a part of its program to concentrate all its efforts on the most indispensable public health services during the war. We are sure that many readers of *Neighborhood Health* will miss this thoroughly instructive and enjoyable publication. The final issue was devoted to a compilation of popularized information on nutrition and was an excellent "swan song" for this valuable periodical.

—From copy prepared for "Credit Lines"—more on pages 317–322.

An Improved Non-Virulent Rabies Vaccine*

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A NON-VIRULENT rabies vaccine has been developed and tested in our laboratory with results which warrant its trial by others both in the laboratory and in the field.

The vaccine is prepared in the following manner: Two months old beagle dogs are injected intracerebrally with mouse brain rabies virus, Pasteur strain. When the animals are prostrate, their brains are removed, weighed, triturated, and diluted with buffered distilled water to make a 5 per cent emulsion. This emulsion is then centrifugalized at 500 r.p.m. for 5 minutes and the supernatant removed. This supernatant, to immunize, must titer at least 330,000 mouse doses per ml. and be relatively free of large particles. It is then rendered non-virulent by exposure to ultraviolet light for 35 minutes. Tests for sterility are made and the vaccine is then ready for use.

This vaccine has been submitted to four types of test, each of which will now be summarized.

Our intracerebral test [1] was first employed with modifications designed to reduce both the amount of vaccine and the number of doses required. Three intraperitoneal doses each of 0.03 ml. of vaccine immunized mice effectively.

This is the smallest total amount and fewest doses of vaccine yet found effective against a subsequent intracerebral injection.

To permit a comparison of irradiated vaccine with others designed for human treatment, commercial phenolized and chloroformized vaccines and our irradiated vaccine were diluted as previously described.[1]

The dilution of vaccine eliminates the effect of phenol and chloroform.

The irradiated vaccine protected mice against 10,000 lethal doses and the chloroformized vaccine against 1,000; a widely advertised phenolized vaccine gave no protection.

TABLE 1

Immunity of Vaccinated Mice to Rabies Virus Injected Intracerebrally

Mouse Group	*Fate of Mice Given Test Virus in Dilutions*					*Titer*	*Amount of Protection in Intracerebral Lethal Doses*
	10^{-3}	10^{-4}	10^{-5}	10^{-6}	10^{-7}		
Controls	—	4/4*	6/6	4/6	1/6	10^{-6}	—
Irradiated vaccine	0/6	0/6	3/6	1/6	—	10^{-5}	1,000+

* 4/4=4 mice died of 4 injected
—=Dilution not tested

* Read before the Laboratory Section of the American Public Health Association at the Seventieth Annual Meeting in Atlantic City, N. J., October 16, 1941.

TABLE 2

Immunity of Vaccinated Mice to Rabies Virus Injected Intracerebrally

Mouse Group	Fate of Mice Given Test Virus in Dilutions							Titer	Amount of Protection in Intracerebral Lethal Doses
	10^{-2}	10^{-3}	10^{-4}	10^{-5}	10^{-6}	10^{-7}	10^{-8}		
Controls	—	—	6/6*	6/6	6/6	4/6	0/3	10^{-7}	—
Phenolized vaccine	4/6	6/6	4/6	5/6	6/6	—	—	$10^{-6}+$	-10
Chloroformized vaccine	3/6	3/6	4/6	0/5	0/6	—	—	10^{-4}	1,000
Irradiated vaccine	1/6	1/6	2/6	2/6	0/6	—	—	10^{-3}	10,000

* 6/6=6 mice died of 6 injected
—=Dilution not tested

We designed the intramuscular test[1] for vaccines with too slight immunizing potency for detection by the intracerebral method. The test simulates natural conditions and permits critical testing of canine vaccines. A single injection of 0.1 ml. of irradiated vaccine is ample to immunize mice consistently against street virus injected intramuscularly.

A third type of test not previously described has been that of infection with virus followed by treatment with vaccine. Groups of mice are given 0.01 ml. of street virus in dilutions into the gastrocnemius muscle and vaccine injections are commenced 3 hours later. Nonvaccinated mice show incubation periods exceeding 14 days and numerous survivors. No phenolized vaccine has given a clear-cut protective effect; chloroformized vaccines occasionally show some. The irradiated vaccine, however, in 5 doses totaling 0.5 ml., prevents rabies in most instances.

TABLE 3

Immunity of Vaccinated Mice to Rabies Virus Injected Intramuscularly

Mouse Group	Fate of Mice Given Test Virus in Dilutions		
	1/10	1/40	1/160
Controls	6/7*	4/6	2/6
Irradiated—1%	0/6	0/6	0/6
Irradiated—2%	0/6	0/6	0/6
Irradiated—5%	0/6	0/6	0/6

* 6/7=6 mice died of 7 injected

TABLE 4

Immunity of Vaccinated Mice Previously Injected Intramuscularly with Rabies Virus

Mice	Controls	Phenolized Vaccine	Chloroformized Vaccine	Irradiated Vaccine
Number tested	77	48	25	79
Number dead	39	18	8	4
Per cent dead	50	38	32	5

TABLE 5

Immunity of Vaccinated Dogs to Rabies Virus Injected Intramuscularly

Dogs	Controls	Phenolized Vaccine	Chloroformized Vaccine	Irradiated Vaccine
Number tested	162	62	52	59
Number dead	136	45	26	1
Per cent dead	84	72	50	1.7

The final experiments dealt with the immunizing effects of irradiated vaccine in dogs. For 3 years young beagle dogs have been tested for resistance to rabies by injecting early-passage street virus into the neck muscles. Of 162 unvaccinated dogs injected with virus, about 84 per cent died. Of 62 dogs given commercial phenolized vaccine 3 weeks prior to the test injection of virus, 72 per cent died. Of 52 given chloroformized vaccine, 50 per cent died. Of 35 given 30 to 40 ml. of irradiated vaccine in a single dose, all were protected save one; of 24 given 5 to 10 ml. of the vaccine concentrated 6 times, all were protected.

In summary, the experiments have shown that the irradiated rabies vaccine is superior to other vaccines now on the market for immunizing mice and dogs against rabies. The vaccine can be prepared within 7 days, released within another 7 days, is relatively free from brain tissue, and appears quite harmless. Finally, its potency and, indeed, the steps in its preparation can be checked quantitatively.

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The Public Health Engineer in a Small County Health Unit*

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PROBLEMS of personnel and personnel functions in the field of environmental sanitation are receiving increased attention from those interested in public health engineering. This interest is reflected in the discussions of fellow workers, in committee work of the American Public Health Association, and in current publications.

In reviewing some of the published material concerning this field of interest, it is evident that one of the major questions under discussion is whether it is practicable and desirable to use trained sanitary engineers for the environmental sanitation work in the smaller units of public health organization. In most cases, it has been generally accepted in theory, if not in fact, that the training of the public health engineer is the minimum preparation necessary to direct the sanitation activities properly in the larger administrative divisions. The acceptance of such a premise concerning the smaller units has not as yet taken place due largely to economic considerations. The rôle of the public health engineer in the smaller administrative units has been ably presented by others,[1, 2, 3] and need not be repeated here. Perhaps one of the reasons that economic considerations play such a strong part in decisions to use less well qualified personnel in the smaller administrative units is the failure of officials to take the time to view in perspective the type of environmental sanitation program which will most effectively and positively influence the planning, design and building of a safe and healthful community.

The experience of seven rural county health departments in southwestern Michigan may, perhaps, throw some light on this question. To a certain extent these county units, coöperating in the Michigan Community Health Project, have unusual resources through the coöperation of the W. K. Kellogg Foundation. Nevertheless they are responsible for the customary public health program including environmental sanitation.

These rural areas have the usual problems of water supply, excreta disposal, milk and food supply, resort sanitation, school hygiene, housing, and those sanitation problems found in small industries.

When the health departments were first established, few of the public water supplies were satisfactorily protected. The percentage of bottled milk that was pasteurized was very low, and other protections usually considered as necessary to a healthful environment were correspondingly poor.

The first step in the approach to the solution of the problems of these counties was one of definition with all that this involves if intelligently done including inspections, tabulations, charts,

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maps, and analysis of facts. Standards had to be agreed upon based on the pooled experience of qualified authorities and as translated into terms of the local situation.

Once defined, a properly qualified person not only applied his technical knowledge to the individual problems of pasteurization equipment, approval of plans for new or improvements to existing water supplies, etc., but he developed a plan of attack, with the approval of the health officer. Together they interpreted the problem to the officials and people of the community in a scientifically correct and forceful manner. Once the people of the community understood, for example, the benefits resulting from the use of a safe water supply and a safe milk supply, and once they understood the procedure necessary to obtain these services, and once the people who supply these services understood their responsibilities, then improvements came as day after night. Both the educational program and the technical program were scientifically sound and convincing.

There is no one way by which a person or a group of people can be influenced on a given subject. The program was directed by both the Health Officer and the engineer to the school board, the school teacher, and the school child; the local physician; the dairyman; the veterinarian; the milk plant owner; the local service club; the newspaperman; the camp to which the child goes; the parents; the motion pictures, etc. All of these factors and more may have a bearing, for example, on a person's attitude toward whether the milk served in the school is pasteurized or raw. A planned specific approach to a program of education directed at the proper points will yield dividends much more readily than a program that has not been properly defined nor adequately understood and accepted by the community. The program of the public health engineer takes into consideration the driving forces that motivate the people he is dealing with.

In the campaign to improve the milk supply the health officer can usually obtain the coöperation of the medical and dental societies, the veterinarians' association, and others that are directly concerned, in the consideration of the scientific facts regarding the effect of pasteurization on milk and in the endorsement of the use of safe milk.

Furthermore, it is important to the progress of the program that the large consumers of milk demand a safe milk. It is important that the people who buy milk for schools, hospitals, camps, and restaurants, for sale or distribution to others buy safe milk. Health departments can influence most of the restaurants and resorts to want a safe milk supply and then should take the positive stand that all establishments must sell only milk that is properly pasteurized. A concentration of all the health department programs that affect milk must be achieved.

It is readily seen that the health officer with a public health engineer has open to him quite a different approach to the problems of environmental control from that of routine inspection of facilities in the field to determine whether sanitation standards are met or whether the law is being complied with.

What applies to the milk situation also applies to problems in connection with a municipal water supply.

For example, in securing the extension of water mains into certain areas of a municipality, that the village fathers in the past had decided could not be served, similar problems are presented. There may be in the area of the municipality eight families living on a street that have been told that the water mains cannot be extended to them because there are not enough connections to justify the first cost. They then have to construct their own water supplies

which may or may not be safe. Later, four more families build on the same street and want water from the municipality. Perhaps with the twelve families there are enough customers to justify the expense involved. But by this time the first eight families, who have spent considerable money to obtain their own supplies, will have nothing to do with the village water. Without question, such a situation requires a knowledge on the part of the public health engineer of the principles of water supply protection, but it also entails an understanding and the application of, let us say, community engineering of the highest caliber to secure the best solution. Such community engineering embraces the problem of securing the coöperation of the village fathers in a consideration of the economic and social problems involved as well as the public health problems. From such an understanding the village council may be expected to assume an attitude which will result in action.

Small semi-public water supplies present the same type of problem. The inspector goes to the school and finds that the well is driven within a few feet of the septic tank. It is obvious that all such dangerous conditions must be corrected, but it is far more important that, from that time on; no future improperly located or protected installations of such a nature be made. This means a positive preventive program, educational and coördinated in plan, for well drillers, plumbers, contractors, school authorities, and others who have a direct relationship with the problem. It is not enough to correct conditions that exist or to make inspections to see if accepted sanitation standards are met. The program, to be effective, must be a positive one to insure that all new work will be done properly. That can be accomplished only when the people who are doing it understand the basic principles of location, construction, and protection of wells, and the people who are having it done understand the necessity for such procedures.

It is certainly desirable to have the school water supply protected, to have the restaurant clean, the milk supply safe, and to have proper and safe systems of excreta disposal. The public health engineer in a rural community has to find ways to make the people want to reach health objectives through their own interest and understanding of the problems.

When a field visit is being made the public health engineer is able to contribute effectively to the accomplishment of an educational goal. To record the number of field visits made, means little. It is most important that the contact be educational. The field forms should be such that the owner of the establishment can see what facilities are necessary and to understand why. It is to his benefit to know.

The office forms containing information secured in the field should be designed for use gradually to develop the community picture, to show needs, to show progress, and to assist in understanding problems and developing sound policies and programs.

It will be recognized that these same factors operate throughout the entire environmental sanitation program. The problems are community ones to be solved through the educational, social, and economic considerations as well as through the application of technical engineering principles. As a consequence, community hygiene plans and programs should be developed on the basis of active participation of the people and groups concerned. Proceeding on this line of reasoning it is apparent that trained individuals can accomplish the objectives much more effectively than can less well qualified personnel. The health officer is more likely to permit properly trained personnel to engage in a far-reaching educational and coördinated type of program which he feels is

basically sound than he will if he has to depend only on less well qualified personnel.

We believe that the fundamental differences between the value of the public health engineer and a less well qualified inspector are apparent when one visualizes such an attack on community sanitation problems.

The approach to these community environmental problems should be on a problem solving basis. First, comes the finding of the problem; second, comes the education of those directly concerned to see the problem; and third, comes the organization of the community resources to help solve the problem. Another way in which we like to think of the problem solving approach is the " what," " why," and " how."

In conclusion, it should be stated that the less well qualified inspector has a place at this time in the cities and larger units of public health organization when working under qualified engineering direction. However, it is felt that the inspector and his program cannot be superimposed on a rural community without technical engineering supervision, unless the local department is willing to accept a less effective type of sanitation program. It appears to us in the Michigan Community Health Project that the public health engineer with his background of basic training which equips him to enlist and coördinate the community forces is a sounder investment to a small county health unit than a less well qualified inspector working independent of qualified engineering direction.

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Carriers and Abortive Cases in a Rural Poliomyelitis Outbreak*

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FOUR children in the Town of Knox, a rural area in Albany County, N. Y., became ill with severe paralytic poliomyelitis on the same day, September 10, 1940. A 5th similar case developed on the following day. Three of these cases occurred in one family.

No case of poliomyelitis had been reported previously in this sparsely populated community since 1922. Although only 5 paralyzed cases were observed, the morbidity rate among the 953 residents in the Town of Knox was 5.3 per 1,000, a rate for paralyzed cases comparable with those seen during the severest epidemics in urban areas.

The Town of Knox is located in a corner of Albany County bordering on Schenectady County. It consists of farms and one small hamlet of 25 to 30 houses. A paved road makes the town readily accessible to the cities of Schenectady and Albany, approximately 12 and 22 miles distant, respectively.

During the 2 months preceding the Knox outbreak, 17 poliomyelitis cases were reported in Albany and Schenectady Counties. Ten of these were in the city of Schenectady and its suburban areas, Rotterdam and Scotia. During the preceding decade, 1930 to 1939, only once had the incidence of poliomyelitis in Schenectady County been higher than in 1940, and that was 9 years earlier in 1931. From 1936 to 1939 there had been only one case reported each year. Thus the Knox episode was preceded by a higher than normal prevalence of poliomyelitis in nearby areas.

METHOD OF INVESTIGATION

Field and laboratory studies were inaugurated ‡ on September 16, the diagnosis in all 5 paralyzed patients having been confirmed by their clinical course and lumbar puncture findings.

With the assistance of a public health nurse, a household canvas was made in each home situated within an area of approximately two miles radius, centering about the 3 families in which paralytic poliomyelitis occurred. The survey was started on September 25 and completed on October 4. In each home a household roster was taken and notes were made of the history of any illness, no matter how slight, during the period September 1 to 24. All the symptoms commonly associated with abortive poliomyelitis were specifically mentioned. Individuals found to have had symptoms suspicious of this condition were checked by an orthopedic nurse trained in muscle grading. No undiscovered cases with paralysis were recognized.

Stool specimens for monkey inoculation were collected from the 5 paralytic

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TABLE 1

Number of Persons Surveyed, Number of Persons with Acute Illness, and Attack Rates per 100 Persons, by Age and According to Association with Poliomyelitis Cases, Knox, N. Y., September 1–24, 1940

Age	Total Persons Surveyed		Total Persons with Acute Illness		Attack Rates per 100 Persons Surveyed	
	Intimate Associates	Others	Intimate Associates	Others	Intimate Associates	Others
0–15 years	23	73	11	17	47.8	23.3
16 years and over	10	267	3	35	30.0	13.1
Total	33	340	14	52	34.6*	15.7*

* Adjusted for age.

cases, from all of their household contacts, from a 4th family, intimately associated with one of the paralytic cases, in which suspicious illnesses had occurred, and from 8 other individuals in whom no contact was discovered. All specimens were collected between September 16 and October 5, the majority being taken from 2 to 3 weeks after the outbreak occurred.

These stool specimens were examined in the Division of Laboratories and Research of the New York State Health Department, by Dr. George Y. McClure. The technic used was a modification of the procedures developed by Trask, Vignec, and Paul (1938), and consisted of the intraperitoneal inoculation of rhesus monkeys with the stool specimen after treatment with ether and lauryl sulfate. Some of the monkeys were also given simultaneous intra-nasal inoculations. A detailed report of the laboratory results is being published by McClure and Langmuir.

SURVEY OF ILLNESSES IN THE COMMUNITY

In addition to the paralyzed cases, a number of acute minor illnesses were discovered in the community. The number of individuals surveyed, the total persons with illnesses, and the attack rates, according to age and association with the poliomyelitis cases, are presented in Table 1. The 33 intimate associates consist of 20 household contacts of the paralytic cases, and 13 close friends of the family in which 3 paralyzed cases occurred. The age adjusted attack rate among the intimate associates is double the rate among the others in the community. This difference is of doubtful statistical significance due to the small number of intimate associates; however, the dif-

TABLE 2

Classification of Types of Symptoms Reported in Survey of Acute Illnesses, Knox, N. Y., September 1–24, 1940

Upper Respiratory	Gastrointestinal	Nervous System
Cold in head	Nausea	Pain in extremities
Coryza	Vomiting	Sciatica
Cough	Anorexia	Backache
Sneezing	Diarrhea	Headache
Sore throat	Pain in abdomen	Stiff neck
Ear ache	Gas on stomach	Dizziness
Tightness in chest		Drowsiness

ference is consistent both among the children and the adults.

The acute illnesses have been classified into 3 groups by symptoms referable to the upper respiratory, gastrointestinal, and central or peripheral nervous systems. The symptoms included in these 3 classifications are listed in Table 2.

The number of acute illnesses, by age and according to type of symptoms and association with poliomyelitis cases, is presented in Table 3. Although the numbers are quite small, rather striking difference in attack rates occurred, as shown in Table 4. The illnesses referable to the gastrointestinal and nervous system predominate among the intimate associates, while the upper respiratory illnesses are concentrated among the others in the community. As with the rates for total illnesses, the differences are of doubtful statistical significance, but they are fairly consistent for both children and adults.

LABORATORY FINDINGS AND CLINICAL OBSERVATIONS

A summary of the results of the examinations of the stool specimens is presented in Table 5. Four of the 5 paralytic cases were found to have poliomyelitis virus in their stools. In the 5th case, doubtful results were obtained which have been discussed in a special report by McClure (1941).

Thirteen of the 27 contacts from whom specimens were obtained gave a history of illness. The onset of symptoms in each of these cases occurred within the 10 day period, September 10 to 19, immediately following the outbreak. Of these 13 intimate contacts with illness, 10 (77 per cent) harbored poliomyelitis virus in their stools, and therefore, may have been unrecognized cases of poliomyelitis. Only 1 of these 10 individuals gave a history of fever which is the basic criterion set by Paul, Salinger, and Trask (1933) for the diagnosis of abortive poliomyelitis. This

TABLE 3

Acute Illnesses, by Age and According to Type of Symptoms and Association with Poliomyelitis Cases, Knox, N. Y., September 1–24, 1940

	Type of Symptoms					
	Upper Respiratory		*Gastrointestinal*		*Nervous System*	
Age	*Intimate Associates*	*Others*	*Intimate Associates*	*Others*	*Intimate Associates*	*Others*
0–15 years	2	12	8	3	2	6
16 years and over	..	29	1	10	2	7
Total illnesses *	2	41	9	13	4	13

* Fourteen of 66 persons ill had symptoms referable to two or more types.

TABLE 4

Attack Rates per 100 Persons from Acute Illnesses, by Age, and According to Type of Symptoms and Association with Poliomyelitis Cases, Knox, N. Y., September 1–24, 1940

	Type of Symptoms					
	Upper Respiratory		*Gastrointestinal*		*Nervous System*	
Age	*Intimate Associates*	*Others*	*Intimate Associates*	*Others*	*Intimate Associates*	*Others*
0–15 years	8.7	16.4	34.8	4.1	8.7	8.2
16 years and over	....	10.9	10.0	3.7	20.0	2.6

TABLE 5

Results of Examination of Fecal Specimens, Knox Poliomyelitis Outbreak September 1–24, 1940

Type of Person Examined	*Number Examined*	*Number Positive*	*Per cent Positive*
Paralytic cases	5	4	80.0
Intimate contacts:	27	20	74.1
with illness	13	10	76.9
without illness	14	10	71.4

patient, a 3 year old girl, had an acute febrile episode with vomiting and malaise. A physician saw her three times but failed to find stiff neck or evidence of muscular weakness. Four other children had mild stomach upsets with vomiting and abdominal pain about which their mother was wholly unconcerned. Two children had mild upper respiratory symptoms, which did not confine them to bed. The remaining 3, 2 children and 1 adult, had symptoms suggesting involvement of the peripheral or central nervous system. The first, a 13 year old girl, had pain in the knees and backache for one day, but she remained in school. The 2nd, a 10 year old boy, had headache, pain in the eyes, dizziness, and soreness in the chest and abdomen. He was out of school for 2 days but his mother denied that he had had fever. The 3rd, a 43 year old man, developed a severe sciatica which necessitated a visit from a physician on September 14. Although the information available on this case is limited, it suggests the polyneuritic form of poliomyelitis described by Wickman (1913).

Of the 3 intimate contacts with illness who had negative stools, 1 adult complained of "gas on the stomach" for one day, another had headache and anorexia, and 1 child had a mild stomach upset with vomiting.

Among the 14 intimate contacts who remained well during the period of observation, 10 (71.4 per cent) were carriers. Out of the total group of 27 intimate contacts, 4 of the 8 adults and 16 of the 19 children harbored the virus at some time.

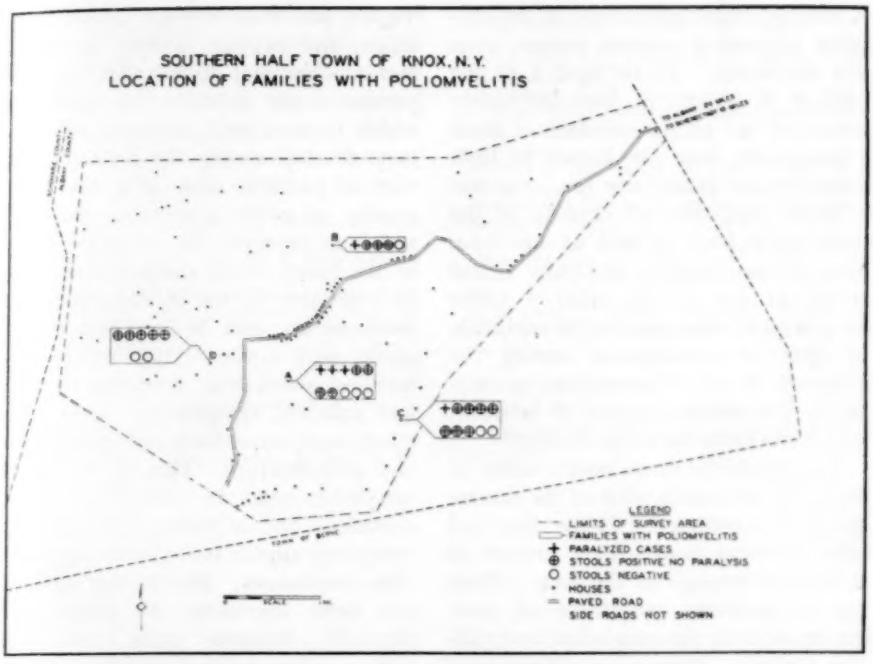
It has been mentioned that 8 specimens were secured from individuals without known contact with any of the paralytic cases. Four of these specimens were from persons in the community who gave histories of previous attacks of poliomyelitis at least 5 years prior to the present outbreak. The 4 other stools were from the members of a family in which 1 child had a febrile illness with vomiting and pain in the abdomen lasting for 2 days. In none of these 8 specimens was the virus found. This group of 8 individuals does not represent a fair sample of the community at large, but the consistently negative results do serve as a check on the validity of the laboratory methods used.

SOURCE OF INFECTION

The chronological and geographical concentration of cases suggests that some unusual characteristics might be discovered in the community or in the activities of the 4 families in which poliomyelitis occurred. The accompanying map shows the location of these 4 families A, B, C, and D, and the distribution of the homes in the area.

Each of the 4 families maintains its own cow, each has a shallow dug well, unprotected from surface pollution, and each has an unscreened surface privy. Although 3 of these 4 families live in extreme poverty, the total lack of improved sanitary facilities is characteristic of the farms throughout the community.

A majority of the population live by farming. A few individuals commute to Schenectady and a small number of city dwellers maintain summer residences. The community is typical of many marginal farming areas throughout New York State, and is quite similar in its sanitary environment to the rural



areas described by Frost (1913) in his studies on poliomyelitis in Iowa.

Three of the 4 families, A, B, and D, are intimately associated. Families A and B, in which 4 of the 5 paralytic cases occurred, are related. The children in all 3 families are regular playmates. Family A and B held a joint party 8 days prior to the outbreak on the A farm. Two days before their onset, the younger children from the A farm visited over the weekend with both family B and family D.

Family C was acquainted but not closely associated with the other 3 families. However, 9 days prior to the onset of the 1 paralytic case in family C, the patient was exposed at a large family party to a number of relatives from Schenectady and Rotterdam.

Only 2 of the members of the 4 infected families had regular contacts outside of the town. The father in family A drove through Schenectady daily on his way to work as a laborer on a construction gang. However, his stool specimen was not found to contain virus at the time it was examined. The oldest boy in the same family worked throughout the summer at a tea shop in the hamlet where he had casual contact with residents from Schenectady, Albany, and other areas. His stool was positive. None of the members of family C had known contact with either of these individuals for at least 25 days prior to the outbreak, but they were exposed to a large number of persons resident in an area where poliomyelitis was prevalent.

Although no direct or indirect contact between any of the known cases in Schenectady or Albany and the 4 infected families in Knox was discovered, the general character of the community, and the ready accessibility of large urban areas give ample opportunity for a variety of contacts of which no knowledge could be obtained. Therefore, the means of introduction of the infection into the community is obscure, but several possibilities are evident.

Although the explosiveness of the outbreak suggests a common source, none was discovered. To be sure, 3 of the families A, B, and D, were intimately associated but all the members of these 3 households were not known to have been together at any one time, nor was it found that they all partook of the same water, food, or milk at any time. None of the members of family C had visited at any of the other 3 farms for several months prior to the outbreak. In spite of investigation among the members of all 4 households, no evidence of a common source of infection for all the cases could be obtained.

The possibility of an insect vector as the means of transmission of the disease has been considered. House flies and other common insects were present in abundance throughout the area. There was a moderate prevalence of mosquitoes of both the anopheline and culicine varieties. However, the location of the 4 families on isolated farms surrounding but not within the relatively concentrated area of the hamlet does not favor an insect vector, although this possibility cannot be entirely ruled out.

Consequently, personal contact among intimate friends and members of each family is the most adequate explanation for the known infections within the community. All the members in 3 of the families A, B, and D were closely associated and intimately exposed to at least one of the paralytic cases within 2 days prior to the onset of the outbreak. The 4th family was exposed throughout 1 day to residents in an area where poliomyelitis was prevalent. The higher attack rate for acute minor illnesses among the intimate associates is confirmatory evidence supporting the contact hypothesis.

DISCUSSION

That contacts of cases of poliomyelitis may harbor the virus in their stools has been shown repeatedly by Trask, Vignec, and Paul (1938); Lepine, Sedallian, and Sautter (1939); and Kramer, Gilliam, and Molner (1939). The present study indicates the extent to which carriers and unrecognized cases may develop among the intimate contacts of paralytic cases in a rural community in which a previous case had not been reported for 19 years. Out of the group of 27 contacts examined, 84.5 per cent of the children under 19 years of age and 50 per cent of the adults were carriers. Half of the contacts remained well. Only one of them had sufficient symptoms to meet commonly accepted criteria for typical abortive poliomyelitis. Thus a variety of symptoms must be considered to be suspicious and of these gastrointestinal symptoms appear to be more suggestive than respiratory. But in this series it has been impossible to differentiate clinically between cases with and without virus in their stools.

Spread of infection through personal contact appears to be the most reasonable hypothesis by which to account for this outbreak. The high proportion of individuals shown to harbor the virus must have offered many opportunities for spread from person to person, both among children and adults. But the finding of virus in the feces by no means implies that the disease was transmitted by water, milk, or food contaminated with such discharges.

The extent to which the infection was present throughout the community was not determined. It may have spread widely without attracting notice, in view of the mildness of the symptoms in the unrecognized cases and the large proportion of carriers observed among the contacts.

Further studies are indicated in which fecal specimens are taken from members of the general population as well as from cases and household contacts. It is reasonable to suppose that such studies would provide laboratory con-

firmation of previously held beliefs as to the wide distribution of poliomyelitis virus during an epidemic, and as to the rôle of unrecognized cases and carriers in its transmission.

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New Methods of Hookworm Disease Investigation and Control*

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THE studies of Keller, Leathers, and their associates [1] clearly show a marked reduction in the recent incidence and, presumably, in the intensity of hookworm infection in the southern states in contrast to the conditions prevailing in 1910–1914 as revealed by the Rockefeller Sanitary Commission. Nevertheless, hookworm disease remains a source of physical disability and economic handicap in certain parts of several states, and considerable amounts of time and money are currently expended by state and local health agencies in its reduction.

Curiously enough, however, the worldwide researches of the last twenty years on the quantitative aspects of hookworm infection have apparently failed to make an effective impact on state and local health authorities. Indeed, the problem is viewed by them almost without exception as a qualitative one. It is taken for granted that hookworm infection is tantamount to hookworm disease. Egg-positive individuals are discovered by annual flotation surveys of school children. The positives are given, or are urged to take, anthelmintic treatment with little regard to their clinical condition, the relative magnitude of their worm burdens, or the probability of prompt reinfection. The only truly preventive values incidental to these efforts are when the incidence information is used in the promotion of sanitary excreta disposal facilities at homes and in schools. Thus, these anti-hookworm programs involve the special interests and activities of laboratory, epidemiologic, engineering, nursing, and local health administrative services, but these frequently are not coördinated because the program lacks a guiding plan or specific direction. Much of the work, therefore, is repetitious, unnecessary, and wasteful.

In an attempt to develop a sound anti-hookworm program that could be effectively and conveniently carried on by local health agencies and to assist in its promotion and effectuation in Georgia, the State Department of Public Health established a Hookworm Service unit late in 1939. Personnel includes a nurse and a sanitarian who give their entire time to this project, and a medical epidemiologist and a director (parasitologist) who devote about half their efforts to anti-hookworm activities.

All requests from local lay or health sources for hookworm surveys must be approved by the director before survey materials are supplied. Thus, he is in position to prevent pointless surveys with their wasteful expenditures of time and materials; he frequently can convert the desire to "do something about hookworms" into a more effective procedure than a flotation survey of school children; and, lastly, he can

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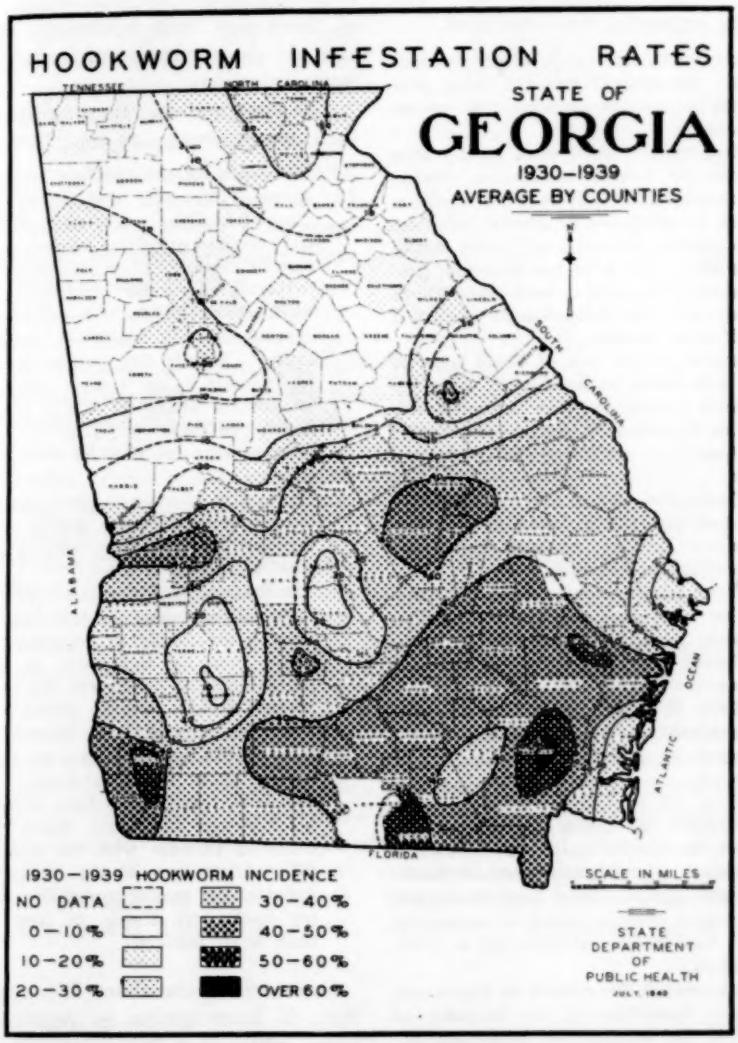
FIGURE 1



regulate and equalize the laboratory load of hookworm examinations to a very considerable degree.

The first step toward a refinement of existing knowledge of the hookworm problem in Georgia consisted of tabulating, by year and county, the previous 10 years' incidences of hookworm infection as determined by flotation surveys. The county rates for this period were then used in developing an isoropic map (Figure 1) showing the state-wide distribution of various classes of hookworm incidence. This provided a useful though not statistically or parasitologically ideal basis on which to plan subsequent investigations.

The next step was to substitute, in the minds of local health personnel, quantitative for qualitative concepts regarding hookworm infection. This was done by keynoting the subject at state and regional health meetings and by making it the topic of discussion be-

fore in-service training groups. The following argument was developed.

1. Adult hookworms suck blood continuously, the amount removed being proportional to the number of worms present.
2. If they remove blood more rapidly than it can be formed, hookworm disease, or anemia, results; if not, the condition is one of subclinical hookworm infection.
3. The primary objective of public health authorities should be the detection, prevention, and control of hookworm disease rather than the elimination of subclinical hookworm infection.
4. Inasmuch as the rate of blood removal by hookworms varies directly with the number present and the rate of hemoglobin formation is normally governed by iron and protein intake, it follows that
   a. Hookworm disease is more likely to occur and will be more severe when worm burdens are high and iron-protein consumption low.
   b. When adequate iron-protein consumption prevails, hookworm infection, with rare exceptions, will be subclinical, whether worm burdens are heavy or light.[2]
   c. When diets are iron-protein deficient, a chronic, progressive anemia will develop irrespective of whether hookworms are present or absent.[3]
   d. Even in hookworm infested areas, therefore, all instances of anemia are not necessarily cases of hookworm disease. Intelligently planned hookworm disease control must distinguish between anemias caused or augmented by hookworms and those due to other causes.
5. To accomplish the control of hookworm disease, knowledge of the intensity as well as the incidence of hookworm infection must be available and this must be considered in relation to the apparent anemia and dietary habits of the people concerned.

The third step was the development of a practical program of investigation and control based on this quantitative viewpoint and available epidemiologic knowledge. It was aimed (1) as the destruction of the greatest possible number of hookworms with the least expenditure of time, travel, and materials, (2) the prompt physical rehabilitation of those sick with hookworm disease, and (3) the prevention of further hookworm infection.

The epidemiologic facts utilized, and their implications, are as follows:

1. Hookworm disease does not occur where approved domestic and school excreta disposal facilities are in use. Thus sanitary sewered or privied sections generally may be dismissed from consideration.
2. Assuming favorable temperature and moisture conditions, hookworm larvae develop best in sandy or sandy-loam soil.[4, 5] Strictly clay regions should not be included in the area of examination.
3. Hookworm disease is rarely, if ever, a health problem in Negroes.[1] Thus Negroes may be omitted from investigation.
4. Hookworm disease is predominantly a disease of low-income families. It is, therefore, usually unnecessary to investigate well-to-do families.
5. The findings of Keller and Leathers and their collaborators[1] have focused attention on the family or household group, rather than the individual, as the important unit of hookworm dissemination in the southern United States. Hookworm investigation and control, therefore, should be prosecuted on a family instead of an individual basis.
6. The same investigators have shown that the average individual worm burden tends to increase with the number of infected members in the family. This indicates the greater probability of finding hookworm disease in large rather than small families.

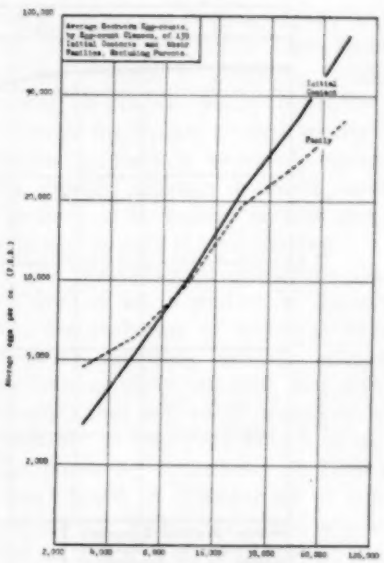
Summarizing the above, it is apparent that, if investigation is restricted to large, white, low-income families living on sandy or sandy-loam soil without sanitary excreta disposal facilities and in which clinical anemia is evident, the majority of the cases of hookworm disease in the area will be encountered.

In apprehending these families, two procedures are in use in Georgia. Where soils, family incomes, races, and domestic sanitation vary widely within a county, direct home visiting without preliminary survey is planned on the basis of soil maps, sanitary survey

maps, and information obtained from welfare agents, county agents, Farm Security representatives, home demonstration agents, physicians, and others whose business takes them into rural homes. Fecal specimens from one or more anemic members of each family, under 20 years of age, are sent to the State Health Department Laboratory and these are examined by brine flotation. Those found positive are egg-counted by the small-drop dilution method of Stoll and Hausheer [7] to obtain some indication of the relative intensity of infection and the corresponding probability that the anemia observed is due to hookworms.

In counties where sandy soils, poverty, and insanitation predominate, home visiting is deferred until the selective school survey has directed attention to families of probable hookworm significance. This is done by distributing fecal containers only to those white school children who show evidence of being anemic. School teachers are invited to assist in the selection because they are able to make their judgments on the basis of activity as well as appearance and because it gives them definite responsibility in connection with this special health program. These specimens are examined in the State Health Department Laboratories first by flotation to eliminate negatives, the positives being egg-counted.

FIGURE 2



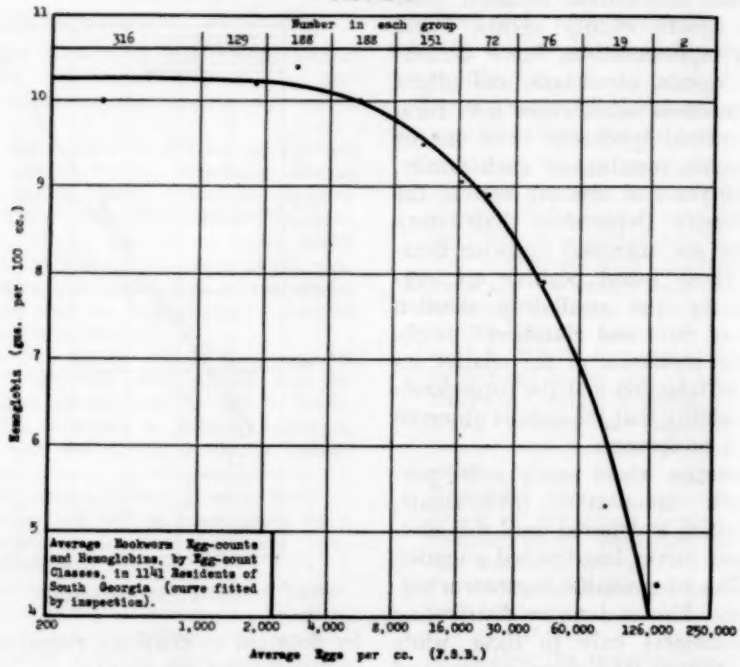
During the development stages of this program, we urged examination of all members of the suspected families. This turned out to be impractical because of non-coöperation, especially of adult males, and the time and travel consumed in repeated visits to the home. This procedure has been abandoned as we presently discovered that in general

TABLE 1

Comparison of Average Egg-counts per ml. of Formed Stool, by Egg-count Classes, of Initial Family Contacts and All Members of Their Families, Excluding Parents

	Initial Contacts		*Families, Including Initial Contacts, Excluding Parents*				
			Number of Members				
Hookworm Egg-Count Class	*Number Examined*	*Average Egg-Count*	*Total*	*Average*	*Positive*	*5,000 or More Eggs per Ml.*	*Average Egg-Count of Positives*
2,000– 4,000	25	2,868	110	4.4	76%	18%	4,692
4,000– 8,000	36	5,419	150	4.2	79%	39%	6,225
8,000– 16,000	28	10,696	104	3.7	92%	60%	9,715
16,000– 30,000	21	22,400	91	4.3	96%	74%	18,607
30,000– 60,000	21	41,181	77	3.7	94%	83%	27,468
60,000–126,000	8	84,550	29	3.6	97%	97%	41,646
Totals	189	18,030	561	4.0	86%	53%	14,080

FIGURE 3



the egg-count of the initial contact, *i.e.*, the first anemic member of the family seen, under 20 years of age, was roughly representative of the average intensity of infection of all positive members of the family under 20 years of age, in which age group most cases of hookworm disease occur in this state. A comparison of average egg-counts of initial contacts and all members of the families is shown for 139 families in Table 1 and Figure 2. Accordingly, we have discontinued routine examination of other members of the family at great saving for both laboratory and local health services.

Similarly, we at first recommended control follow-up of families of anemic individuals with counts of 2,000 or more eggs per ml. of formed stool. This level was selected, more or less arbitrarily, before the results of our own county-wide surveys became available. It allowed a reasonable margin of safety below the egg-count level (2,600 eggs per ml.) at which Smillie and Augustine [9] noted minimal symptoms of hookworm disease in Alabama. Our own observations,[10] shown in Figure 3, on the relation between egg-counts and hemoglobin determinations (Sahli) convinced us that it was pointless in Georgia to attempt control in families where the average egg-count was much below 6,000 eggs per ml. This corresponds in Figure 2 to an average egg-count of 5,000 eggs per ml. in initial contacts. Accordingly, local health personnel are now advised to select for control follow-up families of anemic individuals under 20 years of age whose egg-counts are 5,000 or more eggs per ml.

The families selected by either of these methods do not, of course, include *all* the cases of hookworm disease in the area. If faithfully carried out, however, these procedures, with a minimum expenditure of time, travel, and materials, will direct attention to the

bulk of the true hookworm morbidity, excluding that much larger group with hookworms but no hookworm disease. Attempts to eliminate hookworm from the latter group serve no useful health purpose, with the possible exception of promotion, a purpose which should be served better by an actual rather than a fictitious health problem. Nevertheless, knowledge of these families, members of which are suffering from anemia not due to hookworms, is of health significance as it is generally found that these persons are undernourished with respect to iron. Dietary anemia in Georgia, and apparently in Florida as well,[3] is more prevalent than hookworm disease with which it frequently and perhaps always occurs. This health problem can be economically attacked along with hookworm disease control; indeed, the two health activities effectively complement each other.

What is to be done for these hookworm diseased families once they are identified? First of all, their sick members must be made well. This requires medical service and, as far as possible, is handled by private physicians in Georgia. Indigency is high, however, among hookworm sufferers and it is usually the expressed desire of local medical groups or practitioners that health doctors assume treatment responsibilities for such patients. Anthelminic drugs are supplied gratis to medical men by the state.

The therapeutic problem is a dual one consisting of worm removal and treatment of the anemia. As Payne and Payne[11] have recently shown, hemoglobin recovery following worm expulsion without iron therapy is a long drawn out process. This is especially true when dietaries are iron deficient.[10] On the other hand, while iron administration alone produces rapid improvement in the blood picture, the gains are not sustained unless the worms are removed. So we do both, giving iron, usually as Blaud's pills, *before* deworming if the anemia is exceptionally severe, *i.e.*, 5 gm. or less; *after* worm removal if the anemia is moderate. Educational efforts are made, thereafter, to improve the dietary so that greater iron intake in food is provided, especially for growing children in which the concurrence of hookworm anemia and nutritional anemia is most marked.

The prevention of hookworm disease is, first of all, a matter of sanitation, *i.e.*, the provision of approved excreta disposal facilities, second, education concerning their use and the physical benefits that will result therefrom and, probably, of improved dietary as well if the immunity hypothesis of Cort and Otto[2] based on observations of experimental dog hookworm infection is verified in man.

We, therefore, vigorously promote the sale and use of sanitary sewage disposal structures in homes and schools, but in these days of progressively restricted WPA participation in community sanitation projects, of increasing cost and decreasing availability of materials and of labor, the prospects of seriously interfering with the transmission of hookworms by the use of standard sanitary units are comparatively remote. Families that cannot afford minimal medical service cannot afford pit privies.

In those numerous instances, therefore, in which home sanitation cannot be provided, we are trying to develop definitely preventive values from anthelminic treatment. As indicated above, individuals suffering from hookworm anemia are treated as fast as they are discovered, irrespective of whether or not the premises are to be sanitated. The deworming of other members of the family at that time is not encouraged. If a pit privy is provided and used, there will be no material increase in the intensity of infection and so family treatment is not necessary.

If, however, the household must get along without sanitary facilities, at least one and desirably two worm-removal treatments are urged for all members of the family during the cold months of the year. The object here is to reduce—and, if possible, to eliminate—the family worm burden at a time when immediate reinfection of its members from each other is less likely than it is during the summer months. The unfavorable effect on non-parasitic stages of hookworms of temperatures below 50° F. has been noted by various observers. Augustine,[6] working in southern Alabama, was unable to find larvae in polluted soil from the latter part of December into March. Our own findings in south Georgia, incomplete and inconclusive, confirm this observation. Thus it appears that the soil in this area tends to become free from infective larvae during the winter months and the likelihood of reinfection following treatment at this season is correspondingly remote. This seasonal prophylactic effect is enhanced by the fact that it is during the cold months of the year that rural residents wear shoes if they ever wear them at all.

Two treatments with tetrachlorethylene completely remove worms from about 90 per cent of the patients and reduce the group egg output by 99 per cent.[12] If these are given during the winter to all members of families in which hookworm disease has occurred, it seems improbable that hookworm infection could build itself up to clinical intensities in those families within several years.

This program has not yet experienced the test of time. It is subject to improvement as further field investigations suggest. Nevertheless, we feel that through it we are accomplishing better hookworm control at a lower cost than we did before its development.

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Methods of Production and Control of Normal Human Plasma and Serum*

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UNDER certain circumstances clinical conditions occur which demand the prompt restoration of blood volume. Such conditions prevail particularly following shock, hemorrhage, and burns. Both laboratory and clinical investigations have shown that such volume replenishment can be accomplished adequately by whole blood transfusions, or the intravenous administration of either normal human plasma or serum. The widespread use of the last two substances has opened up a new field of biologic production and control. The present discussion is not concerned with the clinical value or use of these products, but rather with the mechanics of production and methods of safeguarding both the donor and the recipient.

SOURCE OF SUPPLY OF THE RAW PRODUCT

Heretofore in the production of biologic preparations containing blood the scource of supply has been the horse or some other domesticated animal. This has enabled the producing laboratory to keep its scource of supply within the limits of the laboratory itself and without regard to the wishes of the donor. With human plasma or serum such an arrangement is obviously impossible. The producing laboratory is forced to search out the potential donor and by some arrangement, mutually agreeable to all parties involved, arrange for the contribution of a specified amount of blood. How this can best be accomplished depends in a large measure upon the function of the producing laboratory. If it exists as a charitable or community enterprise, it can obtain donors in the following ways:

1. Volunteer donors who come as friends of the laboratory or the community. Such a donor service can best be maintained if it is incorporated into the program of one or more public spirited organizations as, for example, the Red Cross, American Legion, church organizations, Community Chest, lodge, or one of the Service clubs.

2. Volunteer donors provided by the patient from members of his family or friends. In order to give the patient prompt treatment he is treated with material drawn from the reserve supply. The bleedings which he provides in return are contributed later on schedule at the laboratory and these serve to replenish the reserve stock on hand.

A laboratory which obtains its supply of blood through such volunteer services must either have an adequate independent budget to meet its operating costs or must charge each recipient a service fee. Those who cannot afford to pay such a fee should be required to make payment in the form of a specified number of additional donors whenever possible.

As will be stressed later, the operation of a human blood processing laboratory is an exacting task and requires ade-

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quate equipment and well trained, full-time personnel who are responsible only to the director of the laboratory. In order to operate on a sound economic basis, the laboratory must serve a certain minimum territory. Because of these essential requirements, it may be more expedient for a community or hospital to contract with a qualified private laboratory for the processing and control testing on a unit basis. This can be accomplished only if the community or hospital is prepared to furnish the raw product either with or without charge. Economically, such an arrangement is probably less of a burden since the minimum trained personnel and the minimum equipment needed to process even a single unit can process many times the minimum by full utilization of its facilities. There is also the advantage that a privately operated laboratory can ignore institutional and political boundary limitations. An aggressive laboratory director can, therefore, range farther afield and render service to several communities or institutions and proportionately reduce the processing cost per unit. Under such a scheme the financial arrangement between the processing laboratory and each participating unit can be: (a) the raw product plus a unit price for processing with all of the finished product returned to the community of its origin; or (b) the raw product plus a sufficient added amount of the raw product which the processing laboratory shall be free to process and sell in the open market. The latter arrangement will take care of the community which is economically poor, but which can, on the basis of civic interest, obtain bleedings from its members.

There still remains a demand which cannot be met by either of the above plans. This consists of the scattered demand from individual sources which for one reason or another are not eligible for one of the above mentioned supplies. Providing such a supply is the logical function of a private laboratory. It must buy the whole blood needed for processing for cash from individuals who are willing to sell their blood for a price. The extent to which such a laboratory can operate is limited since no community can supply much blood beyond its own needs and under present operating conditions no laboratory is permitted to go very far afield for its raw supply.

MINIMUM REQUIREMENTS FOR BLOOD PRODUCTS

Irrespective of the method of procuring the raw supply, the physical requirements for the donor, the method of taking the blood, and the operation of the processing laboratory must meet certain very definite standards. Laboratories operating entirely within the borders of a single state need only comply with the state regulations. On the other hand, if the operations become interstate in character, the processing becomes subject to the federal Biologics Act since human blood plasma and serum are by definition biologics. Because of the potential dangers both to the donor and recipient, the U. S. Public Health Service has recognized the need of surrounding the processing of human blood products with very specific restrictions. It is sufficient for this discussion to itemize the points covered by these minimum requirements [1]:

1. The donor must be in such physical condition that the taking of 500 ml. of blood will not endanger his health.
2. The donor must be free from any disease transmissible by blood transfusion.
3. The bleeding must be done in an adequately equipped bleeding center which shall at the time be under the control of the licensed laboratory.
4. The bleeding shall be under the immediate supervision of a qualified doctor of medicine, assisted by the necessary trained personnel.
5. The bleeding and all the subsequent steps

involving the blood fraction, until it is injected into the recipient, must be carried out in a closed system.

6. The drawn blood must be placed at 5° C. within 1 hour of bleeding, must be freed of its cells within 72 hours, and if the plasma or serum is to be held in the frozen state or be desiccated, it must be brought to the frozen state within 72 hours.

7. The product from a minimum of 8 bleedings must be pooled and well mixed before filling the final containers in order to dilute the iso-agglutinins adequately and also to equalize the protein content.

8. The product must be sterile as determined by sterility tests made: (a) on the plasma or serum from each individual bleeding or from a sample withdrawn from the pool before the addition of the preservative, and (b) on a specified number of finished containers. Animal safety tests are also made.

9. If the final product is retained in the liquid or the frozen state, it must be placed in a container made of good quality glass, stoppered with a collar type rubber stopper which will permit the entrance of the necessary needles or trochar for administration to the recipient, and the container must be properly labeled.

10. If the final product is processed to the dried state, the finished product must contain not more than 1 per cent of moisture as determined by drying over P_2O_5, the container must be flame sealed or its equivalent under vacuum in a container of good quality glass and so constructed as to permit the vacuum to draw the diluent into the container, thereby permitting solution of the dried product from the vacuum state.

11. Explicit instructions for the solution of the dried product and for the administration of the liquid material should accompany each package. The user should also be cautioned against overheating the product before administration and also as to the imperative need of using a filter in the lumen of the tube leading to the recipient's vein for the removal of particles dangerous for transfusion.

12. There are other refinements in technic of preparation, assembling, and administration which are being observed by the various producing laboratories. These are not included in the minimum requirements, but do add to the quality of the product and to the simplification of the administration.

PHYSICAL CONDITION OF THE FINAL PRODUCT

The degree to which the plasma or serum is to be processed depends primarily upon the degree of stabilization of the component parts desired, upon the storage facilities available, and upon the interval likely to elapse before use.

1. *Liquid plasma or serum*—The preparation of liquid plasma or serum is the most economical both as to equipment needs and production time. Neither preparation is entirely stable since denaturation of the proteins gradually takes place when the product is held in the liquid state. The dissolved fibrin in freshly prepared plasma gradually precipitates with aging, giving serum plus a fibrin clot which must be filtered out before introduction into the recipient's blood stream. The precipitation of the fibrin may be greatly delayed by adding 10 per cent of dextrose to the plasma and avoiding storage at low temperatures. Serum may be stored at 2 to 5° C., whereas plasma should be stored at 15 to 30° C. Where production is for local consumption, and where administration is planned within 1 year, liquid plasma or serum is suitable. On the basis of production costs it is the product of choice.

2. *Frozen plasma or serum*—It has been shown that plasma or serum can be reduced by quick shell freezing to the frozen state without causing any significant alteration in the physical or chemical characteristics of the component parts. Similarly, if it is returned to the liquid state by rapid melting at 37° C., little, if any, change results. Quick shell freezing requires little additional equipment, but does require continuous storage at —5 to —20° C. Production and storage costs are only slightly more than for the liquid product, whereas the frozen product has the advantage of a longer period of usability without denaturation. The full length of this period has not been determined but in all probability it exceeds the 5 year dating period now

allowed dried plasma or serum. If low temperature (—5 to —20° C.) shipping facilities are available the frozen product may be shipped to distant points without harm.

3. *Dried plasma or serum*—Removal of the water content from plasma or serum by quick shell freezing and drying from the frozen state causes little physical or chemical change in the constituents. Studies which have extended over several years have shown that if the product is satisfactorily dried and sealed under vacuum in a good quality glass container, further changes in the composition of the dried plasma or serum do not take place. This permits a very long dating period, probably greatly beyond the 5 year dating period now allowed. In addition, since the temperature requirements for storage of the dried material are not limited as with the frozen or liquid product, it may be shipped to remote places and used under circumstances which otherwise would be impossible. It becomes the product of choice on shipboard, in remote regions of the world, and in case of widespread emergency where reserves must be kept under uncontrolled storage for indefinite periods. However, because added processing steps are involved, the unit cost is greater. Simplification of the processing equipment now generally used can be made, and freeing the processing from questionable overhead charges will undoubtedly result in reducing the unit cost to a point where dried plasma or serum may well become the product of choice for all purposes.

The chief problem involved in preparing the dried plasma or serum is the removal of the water without causing significant changes in the physical or chemical composition of the various component parts and without change in their physiological properties. Experience has shown that this involves the application of certain well understood basic laws of physics and chemistry.

It is of interest to follow the historical development of the application of these laws to the desiccation of biological substances. Knowledge of the mechanical phases of desiccation may be said to begin when d'Arsonval [2] gave his report on the practical production of liquid air in 1898. In 1901, he made his report on the use of low temperatures as a valuable aid in research methods.[3] He recommended the use of methyl chloride in order to reach —60° C., solid carbon dioxide or acetylene dissolved in acetone for temperatures of —112° C., or even —115° C., and finally liquid air in petroleum ether for temperatures below —115° C. Silvered vessels with double walls enclosing a vacuum were used. Vansteenberghe [4] in 1903 applied vacuum over sulfuric acid without regard to the temperature for the removal of water from tissues. In 1906 d'Arsonval and Bordas [5] used two glass receptacles connected by a T tube equipped with a stopcock. Vacuum was obtained with an ordinary pump attached to one arm of the tube. One receptacle served as the drying chamber and was heated by immersing in water at, for example, 15 ° C. The other receptacle served as the condenser and was refrigerated by plunging into liquid air or simply into carbon dioxide snow mixed with acetone. They regulated the temperature of the drying chamber to meet the requirements of the substance under analysis. In 1909, Shackell [6] dried from the frozen state and observed that organic substances dried in this manner with the aid of vacuum and a chemical desiccant retained their physical condition better than when dried at temperatures above freezing. In 1935, Elser, Thomas, and Steffen [7] reported on the accumulated work of the senior author which he states began in 1909. Elser's contribution was the introduction

of the manifold which permitted the connection of many individual containers of frozen material to the condensing chamber. He also contributed the technic of storing the dried material *in vacuo*. A comprehensive analytical study of the physical phenomena involved in the process of drying from the frozen state was reported by Greaves and Adair,[8] in 1939.

It is also of historical interest to observe what substances have been desiccated by the technics just described. Brown and Escombe,[9] in 1898, exposed germinating seeds to liquid air temperatures of —183° to —192° C. and Thiselton-Dyer,[10] in 1900, exposed them to liquid hydrogen temperatures of —250° C. to —252° C. The seeds remained viable. Macfayden and Rowland,[11] in 1900, exposed 10 different bacteria, one yeast and raw milk to liquid air temperatures (—183° to —192° C.) for a period of 7 days without an apparent loss of viability of the microörganisms. Vansteenberghe,[4] in 1903, desiccated rabies virus infected rabbit brain at room temperature and found it viable and fully virulent 9 months later. In 1906 d'Arsonval and Bordas [5] dried a variety of non-viable organic substances without causing any change in the substances. Shackell,[6] in 1909, successfully dried from the frozen state a wide variety of foods and other organic substances, including immune hog cholera serum, the serum of guinea pigs, and fresh uncoagulated dog's blood. Except for the loss of moisture, he was unable to note any change in the substances. Harris and Shackell,[12] in 1911, dried whole rabbit brains and cords from rabies virus infected animals by the Shackell method and the virus was shown to remain infective for at least 4 months. Hammer,[13] in 1911, successfully dried bacteria by the Shackell method of desiccation from the frozen state.

From this historical review of the literature it will be seen that the physical laws essential to desiccation from the frozen state, as we understand it today, were made known and their applicability demonstrated prior to 1912. More recent reports have merely served to confirm the earlier work and to offer refinements in the mechanics of applying these laws to the problem of desiccation.

This discussion would not be complete without mention of the work of Cohn [14] with the serum albumin fraction from human blood. Physical and chemical studies of this fraction, physiological studies of its behavior in laboratory animals, and a limited number of therapeutic trials in humans indicates its usefulness where the problem is one of restoration of blood volume. Serum albumin can be readily precipitated out of plasma or blood with ethanol-water mixtures to whatever degree of purity is desired. It possesses a very high osmotic pressure, has a low viscosity index, and is readily soluble in water. The aqueous solution readily passes through antibacterial filters, and the finished product remains clear and unchanged even under adverse conditions of storage. Assuming that adequate clinical trials confirm the present opinion of its therapeutic usefulness, serum albumin may well replace whole plasma or serum in those instances where the problem is one of restoration and maintenance of blood volume.

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Three Posters

IN the advertising profession the word "standout" is used to describe the exceptional or the meritorious. If the advertising gentry were to judge three venereal disease posters just released by the U. S. Public Health Service, there is no question that these would be termed "standout posters." The posters to which we refer deal with prostitution, blood tests for syphilis, and home remedies for gonorrhea. These are difficult subjects to depict in poster technic and only through skillful interpretation can they be presented for public display. The Public Health Service has used precisely the right approach to these subjects, and the result is a series of posters that are distinguished on many counts. The most striking feature of each is the elaborate, though highly effective, use of color, and the terse text which can be read at a glance. These posters should be widely used, as their forceful messages need to reach many segments of our population at present.

—From copy prepared for "Credit Lines"—more on pages 317–322.

Statistical Work in the Health Department*

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A GREAT many papers have been written and read about the statistical needs of a health department. Much less attention has been given to the problems of actually achieving these objectives and the relative success or failure of the present methods of vital statistics organization in doing so.

Briefly stated, an effective public health organization needs two types of statistical information and service. One includes all that is usually given the name of "vital statistics," whereas the other pertains to the analysis of other types of public health and medical data. With vital statistics are included data about the death rate and the birth rate, the age, sex, and racial distribution of deaths, the causes of death, the proportion of births and deaths which have received hospital care, and all the other vast amount of information which can be obtained from the tabulation and study of birth and death certificates. But the health department needs also the other important type of statistical work. Medicine has passed from the realm of art to that of quantitative science, and to an ever greater degree every aspect of the public health program is being tied to a numerical appraisal of its value and efficiency. In addition to the study of vital statistics, the public health administrator is constantly asking for a statistical and quantitative answer to endless questions, such as: Do the laboratory technics used in the various state laboratories give comparable results? What does the recent survey show about the dental condition of our school children? What data are there to evaluate the success of maternal and child hygiene work? How extensive is venereal disease and how can the progress of the prevention and cure program be evaluated?

These two types of statistical work in the health department are not intrinsically different; they are merely based on data collected in different ways. And a great deal of value of the records of a health department is obtained by studies of the interrelations among data collected from such different sources. For example, upon careful analysis the records of the Division of Vital Statistics yield valuable information. Similarly analyzed, the records of the Infant and Maternal Hygiene Service are of value. However, additional information of perhaps equal or greater value can be obtained by relating these two sets of independently collected data.

If the statistical needs of a health department are visualized in this broad way, it is apparent that from their historical beginnings the state departments of public health in the United States have had an unparalleled opportunity to achieve a high standard of statistical accomplishment. From the early days of American public health work, most state public health offices have had complete control over the collection, tabulation, and analysis of those most impor-

* Read before the American Association of Registration Executives and the Vital Statistics Section of the American Public Health Association at the Seventieth Annual Meeting in Atlantic City, N. J., October 14, 1941.

tant statistical documents — the birth and death certificates. The state health department has had the golden opportunity to develop around these basic vital statistics data a well founded and comprehensive organization for the quantitative study of public health problems and progress.

The unique possibilities of the American system of organization become clearer when it is compared with that of other nations of the Western Hemisphere. In most South American nations, a system for the registration of births and deaths has been long established. However, the principal, almost sole, purpose of this registration system has been to record and preserve the facts of birth and death for their legal value. For this reason, the civil register and the public health office are two completely separate and distinct organizations. As a result, the rapidly growing public health organizations of the other American republics find themselves without the basic mortality and natality data which they need for their work. Having no sources of their own, they are dependent upon what they can get from a civil registration organization which is not appreciative of public health needs nor equipped to supply the service and data for which the public health office has a legitimate use.

In the United States, not all states have taken full advantage of the possibilities of the typical American plan under which the registration of births and deaths is a part of the public health organization. Some states perform a high quality of work in respect to both the objectives of legal registration and in the utilization and analysis of vital statistics for public health purposes. However, it is not an exaggeration to state that, whatever are the *potential* advantages of our present system of vital statistics, in many areas of the country this present system is facing imminent breakdown and failure.

Vital statistics has been an integral part of public health for two main reasons. In the first place, it was believed that the health organization would be a proper and efficient organization to develop and administer registration for its legal purposes. Secondly, it was recognized that a good public health program required the data which could be obtained from a study of the registered documents. It is now apparent that these two objectives are not being generally attained. Recent fast moving developments in the field of vital statistics show that the vital statisticians of this country face serious problems of organization.

It is no secret that registration in this country is not complete. This is particularly true for birth registration. The reason is obvious. For years the problems of registration have been the "stepchild" of the health department. Many health officers, considering registration as extraneous to public health administration, have given little attention or support to efforts to complete and perfect registration. In many instances state officials have been reluctant to enforce registration laws, and no champion has appeared to fight the battle for adequate appropriations for this purpose. As a result, literally millions and millions of American-born citizens now find themselves without any documentary proof of the facts of their birth. And this is now acutely apparent at a time when such proof is of greatest importance for national defense employment, and a hundred and one other purposes.

This underregistration is now having another result which, from the interests of public health, is equally serious. The need for birth certificates has swamped the state offices with requests for certified copies. Many of the 60,000,000 Americans whose births were not originally registered, are flooding the state vital statistics offices with applications

for delayed filing. Each week, the Bureau of the Census is receiving increasing thousands of requests for age certification from Census records. This experience is paralleled in almost every state office. Many state vital statistics offices are now facing a work-load that they are not prepared to meet. To help solve the problem, special clerks are being hired and assigned to the work. During the past several years an incredible amount of WPA funds has been poured into state and city offices in an attempt to complete and bring up-to-date indexes and files of certificates. Only recently the Bureau of the Census has obtained over a million dollars to be spent within 6 months for state help on delayed registration. But the serious point is that all this represents a diversion of money and time from the analytical work of vital statistics. In almost every state this analytical work is being delayed and neglected. Some states have stopped completely the tabulation of vital statistics.

The opportunity to achieve a comprehensive, well integrated public health statistical office is vanishing. The objective of complete registration has not been attained, and many public health administrators now find their vital statistics office to be nothing more than an enormous filing cabinet, rather than a valuable organization to assist in the quantitative study of public health.

A partial solution to these difficulties may possibly be found in a reshuffling or reorganization of the statistical work within the health department. No uniform pattern for a statistical organization is followed by all states. Some states have made special provisions to meet the dual needs of registration and analysis, but many follow the usual pattern of a central vital statistics office with modifications depending upon the present need for analysis, the available personnel, and other resources. The existing kinds of organizations may be grouped into four general types. It is worth while to examine each of these types of statistical organizations and to consider its possible efficiency in reference to the analytical and registration work with which we are concerned.

One type of statistical organization might be called the decentralized system. Under this plan there is no one central statistical office for the whole health department; each different division provides its own statistician. Each division develops its own forms, tables, and methods of analysis. Perhaps it even has its own installation of tabulation equipment. It is obvious that this plan is possible only in a large health department where the different divisions have sufficient statistical work to justify a separate statistical service for each.

Several state public health offices have this plan of independent statistical units, and in New York State, for example, the decentralized plan is quite feasible. In New York State, the Division of Vital Statistics works in collaboration with the statisticians of other divisions, and there is a ready exchange of basic data. But the statisticians employed by the various subject-matter divisions are not administratively responsible to any one chief. A certain amount of integration of work and methods is accomplished by seminars and interdivisional conferences, but the system is definitely decentralized. Although the Division of Vital Statistics carries on extensive analytical research, this research is confined largely to the analysis of vital statistics data.

The statistical service that had been established in Tennessee is exactly opposite in type. In this state, the statistical service is not decentralized but is very definitely concentrated in one central office, which is almost an integral part of the office of the Director of Public Health. The statistical office is a service unit for all of the regular operating divisions of the department.

An important aspect of this plan is that the analytical work on vital statistics, which in most states is done in the registrar's office, has also been taken over by the central statistical service. The Division of Vital Statistics is concerned primarily with problems of registration, filing, corrections, certified copies, and some routine coding. The statistical work is definitely separated from registration work.

Another plan for a centralized statistical service is to be found in the State of Alabama. In this state the analysis of mortality and natality data is not taken out of the Division of Vital Statistics. On the contrary, the analysis of other public health statistics is carried on as a regular function of that division. The regular work of the state registrar is not, therefore, limited to registration problems; it includes the rather extensive statistical analysis of vital statistics data as published in the annual Alabama reports, and also a variety of tabulations and studies for other health department divisions. This service work to other divisions means that the Division of Vital Statistics supplies these divisions with special tabulations of vital statistical data, consults with them on coding, tabulating, and analytical problems, and makes special tabulations of their own data for them. The Division of Vital Statistics also controls the central installation of tabulating equipment and acts as a service unit to administrative statistics.

A new type of organization is now being developed in Louisiana. As a part of a general plan for the reorganization of the state government and the Department of Public Health, there has been created a new Division of Public Health Statistics. Concentrated into one administrative unit are all the functions of collecting, tabulating, and analyzing for the whole health department. That the functions and duties of this division are more extensive than those relating to births and deaths is indicated by the fact that the name of this division is the Division of Public Health Statistics, not the Division of Vital Statistics.

This new division is divided into three main sections—one for registration, one for tabulation, and one for analysis. But the section for registration embraces more than the registration of births and deaths. Included also are morbidity registration and the collection of other kinds of data needed for the health program. Similarly, the sections for tabulation and analysis extend their functions to all other public health statistical problems. In this type of organization, vital statistics in its traditional sense has been superseded by a larger and more comprehensive statistical organization.

To the extent that these organizational plans make provision for public health statistical work and also separate and independent provisions for registration work, they may help solve the basic conflict which now exists between these two competing vital statistics activities. But as long as the total funds are limited, there still remains the basic problem of finding some way to keep the ever-increasing load of registration from overshadowing and smothering the equally important analytical work.

It is not the purpose of this paper to suggest a solution to this dilemma. It is intended here only to present the problem and attempt to stimulate discussion among registrars and public health officials regarding possible methods both to improve registration and to advance the work of the statistical analysis of public health problems.

Perhaps in some states, a reorganization giving more emphasis to vital statistics and an increase in available funds will suffice. However, perhaps the time has now come for a more fundamental change in the vital statistics system. One solution would be for the public health system to give up the responsi-

bility for registration. Following the South American pattern, a state civil registration system could be set up which would be entirely independent of the state health offices. The public health statistical office would then be free to concentrate on the interpretation, publication, and distribution of factual data. Some New England states have always operated in this way. The real importance of the birth and death certificates in the administration of a public health program is the most forceful argument against this complete separation of registration and public health statistics.

Another possibility is for the state public health offices to concentrate on the problems of registration and to discontinue the tabulation and analysis of vital statistics. The statistical data of some other organization, such as the Bureau of the Census, could then be used by the state health offices. This suggestion is perhaps the most unsatisfactory of all because no one would claim that the Bureau of the Census publications can ever be completely adequate for the current administration needs of a health office, nor can they be designed in sufficient detail or in a way to fit the needs of each different state.

The optimum solution is probably neither of these, but some other which combines the advantages of all. Some method must be found that can keep the basic vital statistics data close to, and available for the use of, local and state public health offices. At the same time, some relief must be given the state vital statistics offices in the heavy and responsible work of registration. These offices must be permitted to become truly statistical offices, with the time and facilities to play their full part in the quantitative study, planning and evaluation of the problems and success of the state public health program.

Chorio-Allantoic Membrane Infection as a Diagnostic Test for Smallpox*

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SEVERAL laboratory tests for smallpox have been devised; these may be classified as "infective" or serological. Schultz, Bullock, and Lawrence [1] and others obtained unsatisfactory results with complement-fixation in the diagnosis of smallpox but Craigie and Wishart [2] and others have been more successful. Craigie and Wishart [2] found that complement-fixation was somewhat more sensitive than the flocculation reaction. Of the "infective" tests, the Paul test, which is performed on the rabbit's eye, was employed by Scott and Simon [3] with success. Both Toomey and Gammel [4] and Defries and McKinnon [5] were somewhat less successful, while Jorge [6] and others obtained unsatisfactory results. Defries and McKinnon [5] advocated the difference in dermal response of susceptible and vaccinated rabbits as the basis for a laboratory diagnostic test. With rare exceptions, none of these tests has been reported to give "positive" findings in chicken pox. Each of these tests has failed to win wide acceptance in the United States.

Following the fundamental observations of Woodruff and Goodpasture [7] with the fowlpox virus, several of the pox viruses were propagated in the chorio-allantois of the developing fertile hen egg. Both Buddingh [8] and Irons and his associates [9] suggested that chorio-allantoic infection might have value as a diagnostic test for smallpox. Irons, Bohls, and Hartman [10] found the chorio-allantois was more susceptible than the rabbit's cornea to variolation. Since health officers sometimes desire laboratory aid in dealing with mild, sporadic cases of possible smallpox or with fulminating chicken pox, we have given more attention to the chorio-allantoic infection test.

THE MANIPULATION OF EGGS

A satisfactory source of fertile eggs is a prerequisite. Eggs may be incubated successfully in the bacteriological incubator if a large pan of water is added to increase the relative humidity and other details are given attention. Eggs are likely not to do well in hot summer weather. We have employed essentially the window technic of Goodpasture and Buddingh,[11] which permits ready inspection of the chorio-allantois at any time. Since cutting the egg shells with file or carborundum pencil was rather tedious, we employed a modified dental drill, consisting of a reversible motor with foot pedal control and a flexible shaft, driving a slip clutch handpiece. A candling device enables one to check viability and location of the embryo and attached membranes. Windows were constructed by removing a section of shell flap approximately 1 cm. square over the larger blood vessels

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and by the substitution of a coverslip over a wax base. This operation requires some skill and attention to good technic in order to avoid excessive bleeding by puncturing the membranes. Eggs with windows should be handled with care to avoid adhesion of the cover glass to the membrane. For excision or final detailed examination of the chorio-allantoic membranes, the top of the egg is made bare by cutting around the window.

COLLECTION OF SPECIMENS

Consideration was given dermal lesions rather than blood specimens and throat or nasal swabs. Since sensitivity of the test depends very much on the collection of ample and satisfactory specimens, it is fortunate that the physician is likely to visit the patient when the lesions are rich in virus content. We recommend the avoidance of facial lesions and those elsewhere which have been broken by scratching or rubbing, since these are prone to be mixed with staphylococcal infections or contaminations. Several virgin pustules should be carefully cleaned and rubbed dry with alcohol and their contents should be aspirated individually or in small pools and transferred to sterile moist tubes; the tubes may contain a small amount of sterile, neutral glycerin. The specimens should be properly sealed and rushed to the laboratory, preferably on dry ice or in a cold box. Crusts are likely to be less satisfactory, but should be requested in the absence of semi-fluid contents.

INOCULATION OF EGGS

Several suitable eggs should be employed in each test. Rapid tests for bacteria enable one to use the specimens to best advantage; occasionally it is advisable to request the collection of additional and more suitable specimens. Selected specimens should be triturated or resuspended in a small amount of sterile saline diluent, and a few drops of inocula should be dropped through the windows of eggs on uninjured membranes. One should avoid opening windows longer than is necessary. The use of saline diluent tends to retard excessive dehydration and promotes spreading the inoculum over the membranal surface. The eggs should be incubated at a temperature of 35°–36° C. and should be inspected carefully once or more daily.

DESCRIPTION OF LESIONS OF EXPERIMENTAL SMALLPOX IN PRESUMPTIVE POSITIVE TEST

These descriptive data on experimental smallpox apply to bacteria-free lesions in eggs incubated 10–14 days at time of inoculation. Contaminated or mixed lesions were subject to great variations and frequently resulted in early embryonic death. In the presumptive positive test, the minute lesions were rarely detected in less than 24 hours. The character of the lesions depended somewhat upon the severity of the infection on the membrane. Considerable variations occurred in the number of pocks which appeared, even in the several membranes inoculated with the same material. If 10 to 100 pocks appeared, these usually reached a maximum diameter of about 1 mm. in 72 hours. When a heavier infection with crowding occurred, the average diameter of the pocks was somewhat less; peripheral pocks oftentimes were larger. In about 30 hours the pocks were invariably clearly visible, although scarcely more than pinpoint in size, as watery, raised, rounded, discrete spots. These lesions resembled those in actual smallpox and seemed to evolve through the classical stages of the smallpox lesion, but the whole process was much speeded up and in miniature. As

a rule, individuality of the pocks was well retained until the 4th or 5th day when coalescence occurred, giving rise in the heaviest infections to creamy areas of pustulation, or, in lighter infections, to more rapid formation of areas of desiccating, necrotic tissue. These necrotic plaques were cast off when the chick hatched. The evolution of the lesions, with each of the 18 isolates which we obtained from patients with smallpox, has followed along essentially the same pattern, which was characteristically rather different from what we have observed with influenza, vaccinia, herpes and certain other viruses, bacteria, and fungi. Contents of pustules have given better results than crusts; failures have been much more frequent with the latter.

generally can be attached to the presumptive positive test. To confirm and complete the presumptive positive test, the following criteria have been utilized: (1) increase in number of pocks by sub-inoculation, (2) demonstration of histological picture consistent with smallpox, (3) demonstration of elementary bodies, and (4) significant diminution in pock count under the influence of antivaccinial serum. Not all of these criteria are required for every test.

ATTEMPTED SMALLPOX PASSAGE IN EGGS

At the first indication of smallpox lesions in eggs, and concurrently with sterility and other tests to exclude possible bacterial and related infections, one should attempt to transfer the infection to other egg membranes.

TABLE 1

Summarized Laboratory Findings in Eighteen Cases of Smallpox Established in Chorio-allantois of Embryonated Hen Eggs

Results with Original Specimens and with First Chorio-allantoic Transfer

No. Eggs in Test	*No. Eggs "Positive" **	*No. of Pocks in Membranes †*	*No. Eggs in Test*	*No. Eggs "Positive" **	*No. of Pocks in Membranes †*
10	9	3, 3, 3, 3, 4, 4, 4, 4, 5	4	4	4, 5, 5, 5
18	4	1, 2, 3, 3	4	4	3, 4, 5, 5
8	6	2, 3, 3, 3, 3, 4	4	4	4, 5, 5, 5
12	6	2, 3, 3, 3, 4, 4	4	4	3, 5, 5, 5
18	14	2, 5, others 3 or 4	6	5	4, 5, 5, 5, 5
10	8	1, 2, 2, 2, 3, 3, 3, 4	4	4	4, 5, 5, 5
8	6	1, 2, 2, 3, 3, 4	4	4	4, 5, 5, 5
8	6	4, 4, 4, 5, 5, 5	4	4	4, 5, 5, 5
6	6	4, 5, 5, 5, 5, 5	4	4	5, 5, 5, 5
8	6	1, 2, 3, 3, 4, 5	6	5	3, 4, 5, 5, 5
12	5	3, 3, 4, 4, 4	4	4	4, 5, 5, 5
8	7	3, 3, 4, 4, 4, 5, 5	4	4	3, 5, 5, 5
12	4	1, 2, 3, 3	6	6	3, 4, 5, 5, 5, 5
8	6	4, 5, 5, 5, 5, 5	4	4	4, 5, 5, 5
6	6	3, 4, 4, 4, 5, 5	4	3	5, 5, 5
8	5	2, 2, 3, 3, 4	4	4	2, 4, 5, 5
6	6	3, 4, 4, 5, 5, 5	4	4	4, 5, 5, 5
8	4	2, 3, 4, 4	4	4	4, 5, 5, 5

* Bacteria-free with characteristic lesions
† 1=1–2; 2=3–10; 3=11–50; 4=51–200; 5=above 200

THE COMPLETED POSITIVE TEST

We have generally avoided reporting definite evidence of smallpox until the test was completed; although, as we have gained in experience we have come to believe that much importance

Nearly always in experimental smallpox we have found an increased number of pocks at the first transfer, as shown in Table 1. Each of 18 isolates was carried through several egg passages. Hen egg propagated smallpox was also

successfully transferred on chorio-allantoic membranes of pheasant, duck, turkey, and goose eggs.

HISTOLOGICAL FINDINGS IN EXPERIMENTAL SMALLPOX

Histologically, the well defined foci, corresponding with the visible lesions, and consisting of cellular proliferation, inflammation and necrosis, were invariably outstanding. While all three embryonic layers were often involved, the entoderm was attacked to a lesser extent. The ectodermal cells were particularly involved and these suffered the most pronounced necrotic effects. The mesoderm was edematous in the involved areas and, as the changes progressed, contained an increased number of inflammatory cells which scarcely tended to wander into the entodermal areas. Where necrotic changes were not too pronounced, and particularly in the more involved lesions, intracytoplasmic inclusion bodies were frequently seen in the ectodermal cells. These acidophilic structures varied somewhat in size and shape and were characteristic of the classical Guarnieri bodies. Guarnieri bodies were not found in every focal lesion and particularly with respect to the milder infections.

DEMONSTRATION OF ELEMENTARY BODIES

In carefully prepared films from smallpox lesions, which were stained by the Morosow[12] method, it was usually possible to demonstrate moderate numbers of elementary bodies. The technic was controlled by the use of both uninfected and vaccine infected membranes. In lightly infected membranes one should be sure that an actual pock is spread on the slide. In employing the Morosow or similar technic, careful attention must be given the details to avoid the appearance of ruinous precipitates. Large numbers of evenly distributed elementary bodies, which are commonly found in vaccine films, were seldom encountered in smallpox films.

EFFECT OF HYPERIMMUNE, ANTIVACCINIAL RABBIT SERUM ON POCK COUNTS

Hyperimmune, antivaccinial rabbit serum should exert a protective effect against not only vaccinia but also to a lesser extent against smallpox. We have employed two moderately potent antivaccinial sera with controls in repeated tests with smallpox virus on egg membranes. It was usually possible to obtain a definite reduction in pock count which could be attributed to the influence of antiserum, although the results were subject to considerable variation. Pocks which appeared in the presence of antivaccinial serum tended to be only slightly smaller or delayed in appearance in comparison with controls. Normal rabbit serum and saline diluent respectively mixed in equal amounts with decimal, supernatant virus suspension constituted the controls. Mixtures were left in the cold room at a temperature of 4°–8° C. overnight and a total of 0.4 ml. was pipetted after gentle agitation to each of a dozen eggs in each test.

NEGATIVE FINDINGS

In the presumptive negative test at least 4 embryos should be viable after 48 hours, none of which bear possible chorio-allantoic smallpox or other lesions. In this connection one must be thoroughly familiar with nonspecific changes. Sterile ulcers are most likely to occur in membranes of the younger embryos, and particularly at sites of trauma. Mild surface irregularities may occur as a result of excessive dehydration or for other reasons. The negative finding is completed if the sub-inoculation of pooled, triturated, sterile membranes results in failure to detect smallpox lesions in a satisfactory

group of egg membranes. The completed negative report should be available ordinarily in 96 hours.

ATTEMPTED REPRODUCTION OF CHICKEN POX LESIONS

On numerous occasions we are able to obtain satisfactory specimens from cases of chicken pox. Excepting a couple of clinically doubtful cases, neither of which had been vaccinated and from which the smallpox virus was obtained, the inoculation of chicken pox specimens invariably has failed to elicit the appearance of detectable lesions of the chorio-allantois. Attempted membrane passages, on the assumption that initial reactions might be inapparent, have also given completely negative results and we failed to obtain specific histological changes consistent with those in chicken pox. It seems evident enough that the hypothetical chicken pox virus is unable to affect the chorio-allantois in a visible manner.

PROPAGATION OF HERPES VIRUS IN CHORIO-ALLANTOIS

Dawson [13] and others have described the development of herpetic lesions in the chorio-allantois of embryonated eggs. On several occasions we have infected the chorio-allantois with blister fluid from herpetic lesions, and under standard culture conditions these infections have behaved much alike. By careful daily observation it was evident that herpetic lesions tended to develop somewhat differently from those of smallpox, although it must be admitted that the lesions were occasionally somewhat similar. However, herpetic blisters tended to be smaller, more superficial and irregular, and proportionately somewhat less edematous and short-lived than smallpox lesions. Intranuclear inclusion bodies consistent with those in herpes were also demonstrated. The appearance of herpetic blisters was not significantly influenced by antivaccinial sera.

ATTEMPTED REPRODUCTION OF LESIONS IN MISCELLANEOUS CONDITIONS

We failed to obtain specific chorio-allantoic lesions with blood and dermal lesions from 3 cases of measles. Rake and his associates [14] apparently have propagated the measles virus in embryonated eggs, but the variable, sporadic lesions which these workers have described could hardly be confused with those of smallpox. We also failed to effect chorio-allantoic alterations by means of material from a case of herpes zoster. Dermal preparations in a few instances of drug rashes and likewise from syphilitic conditions failed to elicit specific chorio-allantoic lesions. Staphylococcal infections were encountered frequently in this series but streptococcal or mycotic infections were seen much less often.

DISCUSSION

From 18 of 27 cases of smallpox, characteristic smallpox lesions were reproduced in the chorio-allantois of embryonated hen eggs. Failures were more often encountered in advanced cases where desiccation was most marked. The lesions obtainable in experimental smallpox of the chorio-allantois were applicable in a rapid presumptive diagnosis of smallpox. Standard procedures have been described and the necessity of following standard methods has been stressed in the early recognition of chorio-allantoic lesions. This test involves the reproduction of specific lesions in the absence of bacterial or other agents; in this respect, the goal is pure culture of the smallpox virus. The technic of chorio-allantoic culture is not difficult to master but its application to the diagnosis of smallpox may give disappointing results in the hands of the uninitiated.

Although our experience indicates

that the presumptive positive test ordinarily may be readily confirmed, the completed test should not be neglected and certainly should be performed whenever a doubtful situation arises. Unless quite satisfactory specimens are employed by an experienced worker, a negative outcome should be given only minor consideration in the exclusion of smallpox and should never be allowed as an excuse for neglecting vaccination.

In submitting specimens for a laboratory test, the physician should not relax his efforts at careful clinical observation. The evidence should be considered in the light both from the laboratory test and from careful investigation. In the performance of this test, as in much laboratory work, a disadvantage is attached to dependence upon submission of satisfactory specimens. In our experience, the physician is very anxious for helpful suggestions and appreciates a suitable collection outfit to aid in obtaining satisfactory specimens. It is possible that the sensitivity of this test may be extended by the laboratory application of methods tending to destroy bacteria in the frequently contaminated crusts, or by other refinements of technic.

Our findings corroborate those of Burnet and Lush,[15] Buddingh,[8] and others concerning the apparent insusceptibility of the chorio-allantois to the chicken pox virus and those of Bohls and Irons[16] regarding the practical utilization of chorio-allantoic infection in the embryonated hen egg as a diagnostic aid in suspected smallpox.

SUMMARY AND CONCLUSIONS

Eighteen isolates of smallpox virus were propagated in the chorio-allantois of embryonated hen eggs in an environment free from bacteria and fungi. Characteristic lesions, which were consistent with those of smallpox, appeared in less than 48 hours and were applicable in the laboratory diagnosis of smallpox.

The presumptive positive result was available usually on the 3rd day. Four days were required for the completed negative test. Final identification of the lesions required the application of additional cultural, microscopic, histological, or serological methods.

Tests with chicken pox specimens gave negative results. The chorio-allantoic infection test should be carefully applied in the light of clinical findings and a negative outcome should not result in withholding vaccination against smallpox.

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Rheumatic Fever Reportable in California

ACCORDING to *Western Public Health* the California State Department of Health has made rheumatic fever reportable by physicians.

"Conjunctivitis Spread Checked in Shipyards

"An epidemic of acute kerato conjunctivitis which has affected over 500 employees in shipbuilding establishments in the San Francisco Bay area is being investigated by the Bureaus of Epidemiology, Laboratories, and Influenza Research of the California State Department of Health and the Industrial Hygiene Service.

"A department bulletin states that the condition is evidently infectious in origin but that laboratory examinations of smears and cultures obtained from the eyes of workers have so far failed to identify the causative organism. Animal inoculations have been made to determine whether a virus is responsible for the conjunctivitis.

"Control measures which have been adopted by plant officials upon the recommendation of the State Health Department, including segregation of affected employees, establishment of separate examination and treatment rooms, crews, and equipment for eye cases; thorough sterilization of welding goggles, helmets, and other personal protective equipment; and careful personal hygiene to prevent transmission of the infection from one worker to another, have resulted in a rapid decrease in the number of new cases."

Studies on Syphilis in the Eastern Health District of Baltimore City*

III. Study of the Prevalence of Syphilis Based on Specific Age Groups of an Enumerated Population‡

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ACCURATE measurement of the trend of syphilis is difficult because of certain inherent characteristics of the disease itself and because of factors of selection which frequently operate in studies of incidence and prevalence. For the past five years studies have been conducted in the Eastern Health District of Baltimore City in an effort to evaluate existing methods for the measurement of this trend.[1, 2] A resumé of the problems frequently encountered in prevalence and incidence studies has recently been made by one of us (T.B.T.).[3]

In a disease such as syphilis the operation of an attack rate over a period of years results in an accumulation of persons with syphilitic infection and syphilitic disease of varying degree. Data on this accumulation of past and present syphilitics, defined as prevalence in these studies, are not easy to assemble, for it is necessary to know not only the number of persons in any group that shows evidence of syphilis (*i.e.*, a positive serologic test or characteristic lesions) at the time of the study but also those who have ever shown such evidence in the past.

A study of the extent of this accumulation in the Eastern Health District was initiated in 1939 because of the availability of certain data on the general population of the district. During that year this population was enumerated according to age, sex, color, and certain social-economic factors by the Department of Biostatistics in coöperation with the Baltimore City Health Department.[4] From these records the names of all Negro residents of the ages 20–24 years and 35–39 years were chosen for study.

The age group 35–39 was selected, first, because other studies in the District [1] and elsewhere [5] indicate that the attack rate of syphilis among colored persons of this age group is very low and consequently few persons not already infected will become so after age 35; second, while in a certain proportion of persons with syphilis spontaneous reversal of serologic tests is believed to occur, a minimum of such reversals has probably taken place at these ages. Prevalence rates, therefore, should be at or near their peak.

The ages 20–24 were selected because

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† From the Syphilis Study of the School of Hygiene and Public Health, The Johns Hopkins University.

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the prevalence rates among these persons should reflect the operation of an attack rate in the recent past and thus give an indication of the problem of early syphilis in the area under consideration.

It should be emphasized that these groups are entirely unselected as regards syphilis. While prevalence rates for syphilis based on these groups are not truly representative of the District population as a whole, they may be used as one index of the situation regarding the disease in this community. Moreover, the rates for the same age groups from year to year should accurately reflect the trend of the disease in the District.

METHOD

The area of study consisted of two wards in Eastern Baltimore with a total population of 57,042, 24 per cent of which is Negro. The study group comprised 2,395 Negroes, 17.8 per cent of the entire colored population. There were 467 males and 651 females of ages 20–24, and 646 males and 631 females of ages 35–39.

The name, age, address, hospitals attended, and other pertinent data on every person in these four groups were obtained from the census records of the Department of Biostatistics, and a card was made for each individual. Each card was then checked against our own department syphilis status master file of some 35,000 names of Eastern Health District residents [1] and against the records of various hospitals, clinics, and laboratories in the city in order to disclose any recorded evidence as to the syphilis status of the individual as of 1939. After existing records had been thoroughly searched, a visit was made in an attempt to locate each person on whom no data had been found in order to persuade each one to submit to an examination for syphilis. In order to establish absolute minimum rates, very rigid criteria were used in classification. A person was considered "syphilitic" on the basis of definite diagnostic data; a positive serologic test, a definite history of specific treatment for syphilis, or written records of previously positive serologic tests. For a "non-syphilitic" classification, a negative serologic status did not suffice unless it was accompanied by entirely negative history and physical examination. A person whose status was unknown as of 1939 but who was known to be negative prior to 1939 or found positive since 1939 was classified as "no data" along with those on whom there was actually no information available.

The first classification as regards syphilis status was made therefore on the basis of these very rigid criteria, and the prevalence rates, when computed on the total number of persons in the group, are absolute minimum figures. It is possible, however, to establish a closer approximation to the actual prevalence rates by making certain corrections. These corrections were made for subsequent classifications and are discussed below.

RESULTS

At the close of the period allotted for the study some information relative to syphilis had been obtained on approximately 80 per cent of the entire group. On the basis of these data all persons in the study could be placed in one of the three categories: (1) those found to have or have had syphilis, (2) those who were non-syphilitic, and (3) those on whom no data were obtained. Syphilis prevalence rates were calculated not on the basis of examined persons only but on the basis of all members of the original groups.

Prevalence rates according to age and sex—In Table 1 are shown the prevalence rates for all persons in the two age groups studied. These rates are computed in terms of the *known* syphilis

TABLE 1

Syphilis Status of Negroes Aged 20–24 Years and 35–39 Years in the Eastern Health District 1939

(Definitely Known Syphilis Status Only)

	Age 20–24						Age 35–39					
	Male		Female		Total		Male		Female		Total	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Syphilitic	92	19.7	204	31.3	296	26.5	217	33.6	255	40.4	472	37.0
Non-syphilitic	272	58.4	346	53.2	618	55.3	252	38.9	248	39.3	500	39.2
No data	103	22.9	101	15.5	204	18.2	177	27.5	128	20.3	305	23.9
Total	467	100.0	651	100.0	1,118	100.0	646	100.0	631	100.0	1,277	100.1

status in 1939, and represent the absolute minimum of syphilis infection in each group. In the 20–24 year groups the female rate is 50 per cent higher than that for the males, 31.3 per cent as compared with 19.7 per cent. This order of magnitude was expected because as a rule females are infected earlier than males. The degree of magnitude, however, is startling because it indicates that almost one-third of all Negro females and one-fifth of all Negro males in this area are infected with syphilis before they reach 25 years of age. In the older groups a minimum of 33.6 per cent of the males and 40.4 per cent of the females were syphilitic. The older female rate is approximately 20 per cent higher than that for the males, but this difference is within chance variation. It is possible that the ultimate prevalence of syphilis is approximately the same in the two sexes, the male infection being acquired at later ages than that of the females. The rate for males increases by 70 per cent between the ages of 25 and 40 and that for females only 29 per cent. It should be pointed out here that any actual or estimated number of syphilitics in the "no data" group will increase the syphilis rates. This is taken into account in a later table.

Prevalence rates according to various social and economic factors

Marital status—Table 2 shows the prevalence rates according to marital status. Among single persons of the ages 20–24 the rates for females, 36.4 per cent is twice that for males, 18.6 per cent. The proportion of unknowns was almost identical in the two groups. In each age group the rates for married males were approximately the same as those for single males. The rates for those previously married were higher than either but the differences were not statistically significant. The rates for

TABLE 2

Syphilis Prevalence Rates According to Marital Status of Negroes Aged 20–24 Years and 35–39 Years, Eastern Health District 1939

	Age 20–24				Age 35–39			
	Male		Female		Male		Female	
	Number	Per cent Syphilitic	Number	Per cent Syphilitic	Number	Per cent Syphilitic	Number	Per cent Syphilitic
Single	269	18.6	242	36.4	109	31.2	46	54.4
Married	162	19.1	327	24.5	440	31.8	401	36.2
Previously married	36	30.5	82	43.9	97	44.3	184	46.2
Total	467	19.7	651	31.3	646	33.6	631	40.4

single Negro females in both age groups were significantly higher than those for married ones, but did not differ appreciably from the rates observed among those who had previously been married.

Education—Approximately 9 per cent of the older group had attended high school, whereas 24 per cent of the younger group received at least this much schooling. The prevalence rates among those who reached high school or beyond were generally lower than those among persons with less education. However, only in the younger group were the differences statistically significant. These results may be a reflection of the educational campaign directed to the venereal diseases during the past few years.

Employment status—In all groups the rates among the unemployed were higher than among those regularly employed but the differences were within sampling variation.

Social economic classification *—The group classifications used for the purpose of this study were: (1) skilled and semi-skilled, (2) laborers and no usual occupation, and (3) the servant class. The rates observed according to this classification reflected the rates of the specific age and sex groups themselves and no statistically significant differences could be demonstrated with respect to social-economic classes within the specific groups.

ESTIMATION OF CORRECTED TOTAL SYPHILIS RATE

In all the prevalence rates given above the "no data" group has been considered as entirely non-syphilitic, and the rates have been based on the number of known syphilitics in the total population of the respective age groups. Obviously this is not the true situation, since almost certainly there were some cases of syphilis among the "no data" group. While no information regarding syphilis is available on the individuals comprising the "no data" group, data are available which will permit an estimate of the proportion of syphilitics and non-syphilitics in this group. When such an estimate is made, an inclusive prevalence rate for the entire age group may be computed.

In order to estimate the number of cases of syphilis in the "no data" group, two corrections have been made. First, there are a number of persons in the group on whom some evidence regarding the presence or absence of syphilis is available, although this evidence does not satisfy the rigid requirements set forth at the outset. For example, in the 35–39 year age group there are 19 persons known to have a negative syphilis status after they had reached the age of 30 years, although no examination had been made during or subsequent to 1939. Since the annual discovery rates for early syphilis in this community are known to be low for Negroes between 30 and 39 years of age (7.0 per 1,000 for males and 2.6 per 1,000 for females)[1] it seems reasonable to assume that nearly all of these persons remained free of syphilis during the few years subsequent to the recorded examination. For the same reason, the 26 persons of this age group who were found to have latent syphilis in 1940 or the first half of 1941 may be considered to have been syphilitic during 1939. In computing the corrected rates, then, the status of both of these groups has been changed from unknown to known.

The second correction was made on the basis of prevalence rates among known groups believed to be relatively homogeneous, with respect to the prevalence of syphilis, with the "no data" group. In order to make this correc-

* Classified according to *Alphabetical Index of Occupation by Industries and Social Economic Groups*, U. S. Dept. of Commerce, Bureau of Census, 1937.

tion the entire study group was reclassified according to the type of information on which the syphilis status was based, as follows: (1) those on whom data were supplied by existing records, (2) those on whom data were obtained by subsequent examination, and (3) those on whom no information at all was available. In Table 3 the prevalence rates for classes 1 and 2, are given and the first correction noted above has been made in the " unknown " class.

per cent of the males and 56.8 per cent of the females had been so diagnosed.

On the other hand, the prevalence rates among those on whom there were no existing medical records but who were persuaded to submit to an examination, Class 2 were much lower, being for age 20–24, males 10.8 per cent and females 18.2 per cent; for ages 35–39, males 27.6 per cent and females 34.2 per cent. As far as can be determined the only variable factor between Classes

TABLE 3

Prevalence Rates Based on Existing and Subsequently Obtained Data on Negroes Aged 20–24 Years and 35–39 Years, Eastern Health District 1939

(Includes Both Known and Probable Syphilis Status)

	Age 20–24				Age 35–39				
	Male		Female		Male		Female		Total
Class	Number	Per cent Syphilitic	Number	Per cent Syphilitic	Number	Per cent Syphilitic	Number	Per cent Syphilitic	Number	Per cent Syphilitic
1 Data from existing records	201	38.1	366	48.1	300	60.4	382	56.8	1,249	52.2
2 Data obtained subsequently	166	10.8	192	18.2	192	27.6	143	34.2	693	22.4
3 No data obtained	100	?	93	?	154	?	106	?	453	?
Total	467	20.3	651	34.0	646	36.2	631	42.0	2,395	33.2

It is obvious that groups for which data existed and those for which no data were obtained are not comparable because the former comprise persons who seek medical care, many of whom seek it for syphilis itself. This is reflected in the high rates for Class 1. Among the 20–24 age groups 38.1 per cent of the males and 48.1 per cent of the females had been diagnosed as syphilitic, and among the 35–39 ages, 60.4

2 and 3 is that members of the former Class were persuaded to report for examination while those of Class 3 were not. In respect to marital status, duration of residence in the Eastern Health District, employment, education, and other socio-economic factors, the two classes appeared to be homogeneous. It seemed a reasonable procedure, therefore, to apply the rates for each age and sex of Class 2 to the corresponding

TABLE 4

Estimate of the Total Prevalence Rate for Syphilis Among Negroes Aged 20–24 Years and 35–39 Years, Eastern Health District 1939

	Age 20–24						Age 35–39					
	Male		Female		Total		Male		Female		Total	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Syphilitic	106	22.7	228	35.0	334	29.9	276	42.7	302	47.8	578	45.3
Non-syphilitic	361	77.3	423	65.0	784	70.1	370	57.3	329	52.2	699	54.7
Total	467	100.0	651	100.0	1,118	100.0	646	100.0	631	100.0	1,277	100.0

members of Class 3 in order to obtain an estimate of the number of syphilitics "expected" among the unknowns. These "expected" numbers were added to the number of known syphilitics and new prevalence rates were computed. These rates are given in Table 4 and are higher than those of Table 1 for reasons previously given. The final corrected syphilis prevalence rates for the 20–24 age groups are males 22.7 per cent and females 35.0 per cent; for the 35–39 age group males 42.7 per cent and females 47.8 per cent.

DISCUSSION

In prevalence studies on syphilis the accuracy of the results depends largely on two factors. The first factor is related to the selection of the group to be studied, for it should be chosen without reference to syphilis. The second factor is the manner of selection of the individuals within the chosen groups. Practically, this means that the number of persons on whom no information is available should be relatively small and that there should be some rational method of estimating the prevalence rate among them. Moreover, the accuracy of a study is further enhanced by the inclusion of those who have shown evidence of syphilis in the past as well as those who present evidence at the time of the study.

These favorable factors obtained to a degree in the present study, for an attempt was made to secure information on all persons belonging in one of two groups, selected solely on the basis of race and age. Definite data regarding syphilis were obtained on about 80 per cent of these persons and information was available which made it possible to estimate the prevalence of syphilis among the remainder.

These principles have been embodied to a varying degree in previous studies of this nature. In a review of their own and other studies Maxcy and Brumfield [6] point out the limitations of serologic surveys in estimating prevalence as well as the limitation of surveys of treatment agencies and hospitals. They studied a sample comprising 40 per cent of the Negro population of Albemarle County, Va., but excluded patients examined at the University Hospital, jail inmates, and court cases. In those studies rates were based on the proportion of positives among those tested and no attempt was made to apply rates to the unknown groups, nor to inquire as to the previous syphilis status of those whose tests were negative.

Roberts and Williams [7] approached the matter in a somewhat similar way by applying to the unknown group the rates obtained in a random sample of a non-clinic population. However, in determining the age specific rates, clinic registrants were omitted from the analysis.

In most of these studies based on serologic surveys, a declining rate after age 35 was observed. This has been attributed to one or more of the following factors: reversal of serologic test to negative with or without treatment, a higher death rate among syphilitics, and a previously operating lower attack rate. The rates obtained in the present study, based on serologic testing and history, are from 25 to 50 per cent higher in the 35–39 age group than in the ages 20–24 among both males and females. It was not possible from this material to determine what proportion of the syphilitics had experienced serologic reversal. However, the latest test in 13 per cent of the young syphilitic group and 16 per cent of the older was negative.

SUMMARY

1. From an enumerated population, all Negroes aged 20–24 years and 35–39 years, were selected for study, and an attempt was made to determine the syphilis status of each.

2. From a study of existing records and from examinations made during the course of the study, minimum prevalence rates were established. These rates are as follows: ages 20–24, males 19.7 per cent, females 31.6 per cent; ages 35–39, males 33.6 per cent and females 40.4 per cent.

3. Among females of both age groups the rate for single persons was higher than for the married. The highest rate recorded was 54.4 per cent among single Negro females 35–39. The rates for males, married and single, were approximately the same within each age group.

4. Rates determined according to educational status were slightly higher among those who had not attended high school.

5. The rates were slightly higher among those unemployed than among the regularly employed.

6. The rates among skilled and semi-skilled workers were about the same as those among laborers. The servant class in all except the young males had higher rates than laborers.

7. Of the three groups, (1) existing data found, (2) examined subsequently, and (3) no data obtained, the latter two were quite similar in composition. Consequently the rates of class 2 were applied to class 3 for a final estimate of prevalence which was: ages 20–24, males 22.7 per cent, females 35.0 per cent; ages 35–39 males 42.7 per cent and females 47.8 per cent. These rates take into account the known syphilis status and the probable syphilis status of those examined, and the expected syphilis status of those not examined.

8. It is believed that the method of study employed here is susceptible of application in subsequent years, and that the prevalence rates so obtained will afford a reliable index of the trend of syphilis in this community.

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IN DEFENSE OF SQUARE PEGS IN ROUND HOLES

IT is inevitable that strong and far-flung corps of amateur strategists arise whenever there are rumors of war, or war. This on the whole is probably a very good thing. It tends to maintain public interest and public morale. It creates a sort of loyal opposition to whatever is being done. It encourages map study and, of no small importance, it whiles away the time of those not immediately engaged in more productive occupations. It would be disastrous, of course, if these easy-chair and cracker-barrel plans were put to the test, and to prevent this God has wisely forbidden that the disposition of the fleet or the allocation of lend lease material should ever depend upon the decisions of those uninformed as to the whole problem and untrained in military strategy.

Because of this divine prohibition, then, it is quite safe at luncheon, temporarily to take military matters entirely out of the hands of General Marshall, and it does no harm to shift submarines and destroyers from the Atlantic to the Pacific and vice versa. But those in the medical profession and in professions complementary to it are not so far removed from the affairs of the medical corps of the services as the ordinary layman is from military strategy. Physicians are the ones who are or will be serving as strategists and tacticians in military medicine, and their criticisms of the way in which the medical services are being expanded do not always fall upon as sterile ground as does the vehemence of amateur strategists in general. One physician is influenced by the opinion of another and, unless one knows at least as much of all the problems and facts as do the Surgeons General and their staffs, it is probably not wise to take the responsibility for shaping the thoughts and actions of other physicians and the public.

Particularly harmful is the recounting of stories that imply distressing stupidity in the assignment of medical officers to duty. One hears of the plastic surgeon assigned to the examination of recruits, the laboratory man serving as regimental surgeon, the trained public health man performing sick call duty, of large numbers of medical officers twiddling their thumbs. Perhaps these things have occurred: it would be strange in so rapid a service expansion if they did not; and their occurrence would undoubtedly be distressing and discouraging to the particular

officers concerned. But does anyone imagine, if and when such things happen, that those responsible do not know they are undesirable, or imagine that every effort is not being made to prevent and correct them? One on the outside who criticises the placement of square pegs in round holes should be sure that there are not more round holes and square pegs than there are square holes and round pegs. Even if this is not the case the critic should be certain that round holes are not, at this time, a more serious problem than square ones; and he should withhold his criticism unless he is quite sure that it is better to leave round holes unfilled than it is to fill them partially with square pegs. In sounding off about medical officers not fully occupied, would the critic be willing to assume responsibility for not developing immediately, in view of future needs, a medical corps larger than is necessary to meet today's demands?

We for our part feel that these criticisms, off the elbow as it were, are to be deprecated. They tend to make physicians reluctant to offer themselves for military service, and when they do go into the medical corps, as many of them must, they may enter upon their duties with a lack of faith in their superiors. And finally, to reach decisions when all the facts are not known reflects neither mature judgment nor scientific restraint.

MATERNAL HEALTH AND DIET

FOR a long time there has been need of substantiable data as to the beneficial effects of an adequate and balanced diet during pregnancy. It has been hard to obtain evidence of this sort and, except for sporadic and specialized bits of information here and there, the belief that diet would influence favorably both mother and child has, therefore, rested largely upon observation and general experience rather than upon controlled experiment. In the recent past, however, most encouraging advance in procuring objective findings has been made by Ebbs and his associates in the University of Toronto.

Dr. Ebbs presented a brief report of this work at the 1941 meeting of the American Public Health Association, but the publication rights to this material had been promised elsewhere. His findings, however, are of unusual interest and importance to public health workers, and those who wish to study one of his early reports are referred to the paper, *The Influence of Prenatal Diet on the Mother and Child,* which appeared in the November issue of the *Journal of Nutrition.* We are advised that other aspects of these studies will be presented, from time to time, in appropriate publications.

What Ebbs and his associates have done is essentially this: There were 380 prenatal cases, who had not reached the end of the sixth month of pregnancy, and who presented no major disease. One hundred and seventy appeared to have a reasonably good diet, and this group, designated as the "Good Diet Group," received routine care plus continuing advice as to diet. The other 210 had poor diets. Of these, 90 were provided routine care plus supplementary food necessary to provide a reasonably adequate diet. These were designated as the "Supplemented Diet Group." The remaining 120 cases had routine care but were left to their own devices and resources as to diet, and were designated as the "Poor Diet Group."

Apparently every care was exercised in an attempt to hold constant in the three groups all factors other than diet. Detailed analyses were made of each

patient's food at the beginning of the study, and were repeated two months later. Hemoglobin, vitamin C, and phosphatase were checked by blood examinations, and an obstetrical rating was given each patient in the prenatal period, during labor, and in convalescence. This rating also included condition of baby at birth, ability of mother to nurse the infant, and a rating for the whole course of pregnancy for the time each patient was under observation. Babies were examined at six months and twelve months of age, detailed records being kept. It is of interest, too, that the obstetrical ratings were made by one unfamiliar with the diet group in which patients were carried.

This description, of course, represents only the bare framework of the study. Space does not permit recounting of the various checks and counterchecks utilized to insure accuracy and avoid selection, nor is it possible to present the findings in detail. However, the author's own cautious summary, which is substantiated by tables, is extremely significant: "It would appear from these observations that poor nutrition in expectant mothers results in an increase of anaemia and infection during the prenatal period, in more sepsis and haemorrhage during labour and the puerperium and more complications during convalescence. It would also appear that the improved nutrition of these women has resulted in fewer miscarriages, permatures, stillbirths and deaths during the first months of life. There was a marked difference in the incidence of illness in the babies. This decrease in maternal morbidity, infant morbidity and mortality has resulted in less hospitalization and medical care. Whether future examinations will reveal any changes in the teeth, in physical or mental development will have to await time."

"The results of these observations seem to justify the importance which has been attached to instruction of the expectant mother in matters relating to diet. That many incomes are inadequate for providing proper nutrition is well known. Increased relief rations during pregnancy would appear to be good insurance. The cost of the food sent to the mothers in this study averaged $25.00 per patient (for four and one-half months)."

Dr. Ebbs' conclusions are as follows: "By supplying certain simple foods to the diets of low-income expectant mothers, the incidence of complications during pregnancy was less and the outcome of the infants up to the age of 6 months was markedly improved."

Here is something definite that public health workers may well explore, both in terms of further investigations and in concrete application in the field.

Credit Lines

A Selective Digest of Diversified Health Interests

D. B. Armstrong, M.D., and John Lentz, M.S.

EVERY LITTLE BIT HELPS

In every office where editorial work is done one hears, with increasing frequency, talk of shortages and priorities in the publishing field. That publishers must cope with diminishing paper supplies, or inferior grades of paper, is no longer a remote possibility. There are also reports, presumably well founded, that colored inks will likewise become scarce and that certain metals used in making plates and cuts must be allocated for more vital purposes. These circumstances make it imperative for every agency utilizing printed matter to plan future publications not dependent upon the use of materials upon which the government has first call.

The production of health literature is no small item in the publishing field and the time has come when health agencies should consider ways and means of conserving paper and other publishing necessities. What about the outside back covers of your health pamphlets? An inventory of a large collection of pamphlets from various health agencies reveals that this space is almost never utilized. Why? Perhaps the writers simply ran out of something to say or else the space was left blank for esthetic reasons. It is somewhat strange that this should be true when one considers that outside back covers of magazines are eagerly sought by advertisers who are willing to pay large sums to place their copy in this space. We hereby propose—for the duration—a Society for the Full Utilization of Outside Back Covers. Will you join up today?

There are other ways in which we can contribute to the conservation program. Writers of health pamphlets might put themselves on a word-and-space rationing basis. Boil down everything there is to say—" make every word work or fight." Then there is the matter of margins. Although wide margins and white space enhance the appearance of any publication, we can forego these luxuries in the name of war economy. As for color, health publications seldom splurge on this item. Hereafter when tempted to turn out a " two-color job," carefully consider that impulse. Black and white can be used most effectively when mixed with a dash of ingenuity. There is also the question of the size of health publications. " Vest pocket editions " might well be adopted as a uniform size for our literature until materials are again plentiful.

Perhaps we may feel that the restrictions we face will " cramp our style." It is well to remember, however, that circumstances which test one's ingenuity are often blessings in disguise. When put on short rations we may become increasingly skillful in using the tools at our disposal.

AN EDITORIALETTE: INDIFFERENCE—THE DEADLIEST DISEASE OF ALL

For defense or for total war we cannot afford human waste—especially where it is most controllable, namely *in our civil population.* Disease and physical deficiency are wastes of the most destructive kind. To curb and eliminate them is an obvious need in

Please address samples of printed matter, comments, or other editorial contributions to the editors at One Madison Avenue, New York, N. Y.

peacetime; it is a patriotic duty in time of war. Surgeon General Parran has stated that the physical fitness of the people in this emergency "will determine almost entirely the effectiveness of all other defense efforts."

Yet it has been estimated that in our more mature age groups today, probably 70 per cent of the handicap of disease results from functional disorders or premature degenerative conditions that are preventable or readily detectable, or easily controlled or postponed in their incipiency. This means an unnecessary burden upon our productivity, and an excessive load on our medical profession—a luxury which we can now ill afford, in view of the impending scarcity of professional services of all kinds.

This appears to reflect a form of negligence or indifference not only by the uninformed and underprivileged, but, more significantly, even by those with the means, the information, and the intelligence necessary to their own assistance. Most Americans, after all, have the facts about disease prevention, or know where readily to secure them.

Perhaps many of us have still to realize the importance of individual health maintenance as a patriotic obligation, especially in this time of stress. Individual health is an asset and a social contribution at all times. Now, more than ever, we owe its enhancement to ourselves and our families, to the conservation of professional resources, to the ultimate conquest of preventable disease, and to the service of our nation at war.

An understanding of the relation of individual health to national vitality will help us to a conquest of Indifference—the Deadliest Disease of All.

(EDITORIAL NOTE: Won't you help us continue this series of "editorialettes"? There must be many subjects in the field of health education upon which you would like to express an opinion. Let us have your thoughts on any of these subjects. You may praise, criticise, or philosophize—provided it is done in not more than 150 words. While we cannot guarantee publication, serious consideration will be given your contribution.)

RECENT HEALTH PUBLICATIONS

You will want to see. . . .

Trouble in the Midriff, the latest addition (No. 5) to the Workers' Health Series. The U. S. Public Health Service has seldom produced any popular health publications that are as cleverly done as the booklets which make up this series. The most recent booklet designed for the worker deals with "stomach trouble," which "causes 20,000,000 days of lost time yearly." *Trouble in the Midriff* explains the nature of "stomach trouble" and offers sound advice to those who are victims of this "disease" in one form or another. The booklet, like others in the series, is illustrated with amusing sketches, and the light-veined, though informative, copy is a joy to read. Available from the Superintendent of Documents, Washington, D. C.

Cracking Up Under the Strain, a reprint from *Hygeia*, that may now be procured in booklet form from the Bureau of Health and Public Instruction of the American Medical Association, 535 North Dearborn Street, Chicago, Ill. This is a particularly timely publication, since longer hours of labor are now required and the stresses and strains of wartime are increasing. This booklet presents a thoughtful analysis of those factors that often lead man to dig his own grave. Suggested remedies for "the strenuous life" are discussed—remedies that will make for calmness, steadiness, equanimity, and relaxation. Health agencies will probably have use for literature of this type as the population faces more and more of the realities which come to a nation at war.

Single copies of this publication are sold at *10 cents* and quantity prices are furnished on request.

First in Your Thoughts, a publication of the Maternity Center Association, 654 Madison Avenue, New York, N. Y. Health agencies are beginning to issue a new type of literature to acquaint the public with measures that must be taken during emergencies. A splendid example of emergency health literature is this leaflet from the Maternity Center Association. "You should be ready to have the baby at home" is the warning sounded in this publication. Articles necessary for the mother and baby, instructions as to how to prepare the bed, facts about labor and the delivery of the child, are among the subjects discussed for the benefit of the layman who may be forced to take over the duties of the nurse or doctor should our normal medical facilities be disrupted. This is exceedingly valuable information which all prospective parents should have—emergency or no emergency. The leaflet is priced at *50 cents* per hundred copies.

Health Is No Puzzle, a leaflet issued by the Connecticut State Department of Health. This is a novel presentation of the nutrition problem in which certain essential foods are shown as parts of a jig-saw puzzle. When fitted together, the puzzle forms a daily food picture made up of those nutrients that insure health, vigor, and vitality. This original approach to the subject should prove most effective in teaching children elementary food facts. Address the State Health Department, Hartford, Conn., for copies.

How's Your House? a booklet prepared by the Philadelphia Housing Association, 1717 Sansom Street, Philadelphia, Pa. Here is an effective leaflet that will promote interest among all classes of tenants and owners in "keeping the home fit." Those aspects of housing that are directly related to healthful living—sanitation, cleanliness, lighting, ventilation, and safety—are stressed in this booklet. You will like the illustrations and the text. Write to the above-mentioned organization for copies.

Course of Lessons in Food Selection and Cooking, prepared by the Nutrition Committee of Greater New York, 105 East 22nd Street, Room 200, New York, N. Y. This material is intended for the use of professionally trained nutritionists who teach groups in community nutrition programs. The course outlines points to be covered in six 2 hour lessons. Each lesson includes simple instruction on the nutritive value of a given food, with directions for a cooking demonstration using that food in a meal plan. Recipes for a variety of low cost foods, a reference list for teachers, and a food quiz are also included in the contents. This publication is priced at *15 cents* per copy and is well worth it.

Tuberculosis, a new and up-to-date booklet published by the Metropolitan Life Insurance Company, 1 Madison Avenue, New York, N. Y. This publication was prepared in coöperation with the National Tuberculosis Association and the American Trudeau Society. It covers rather completely those aspects of the disease and its treatment about which the general public should be informed. Increased demands for literature on tuberculosis will no doubt be experienced by many agencies in view of recent newspaper publicity regarding the predicted rise in the tuberculosis death rate. The Metropolitan booklet is available without cost.

THREE FILMS

"Hidden Hunger" is the timely title of a new two-reel picture presented by the Federal Security Agency for use in the national nutrition program. As an

educational picture it is somewhat limited in scope, due to the film's short length. "Hidden Hunger" does, however, effectively stress the importance of a wide dissemination of essential nutrition knowledge and the necessity for providing the right foods for all types of people. The theme is developed along somewhat unusual lines, a fantasy approach being utilized. The picture is also well acted by a competent cast, including Walter Brennan, one of Hollywood's leading character actors. From the standpoint of its entertainment value, this picture is better than most films that are now available on the subject of nutrition. "Hidden Hunger" is, at present, for theatrical use only. Communications regarding the picture should be addressed to "Hidden Hunger," Room 401, Graybar Building, New York, N. Y.

The American Social Hygiene Association has released a new one-reel film on gonorrhea entitled, "Health Is a Victory." This is a well balanced presentation in which the facts about gonorrhea—its diagnosis, treatment, and cure—are told in simplified language. Featured in the film are several animations and diagrammatic sketches showing the prevalence of the disease, how it spreads, and how it affects the human organism. Information concerning modern methods of drug treatment and the dangers of self-medication is also stressed. There are no objectionable features to the film and it is particularly well adapted for showing to mixed audiences. "Health Is a Victory" is available in both 16 mm. and 35 mm. prints (for sale or rent) from the American Social Hygiene Association, 1790 Broadway, New York, N. Y.

Under the auspices of the First Aid, Water Safety, and Accident Prevention Service of the National Headquarters of the American Red Cross, a new four-reel film on first aid was recently released. The picture was made in coöperation with the New York City Chapter, the staff of which appears in the cast. The film is essentially a review of certain standard first aid procedures, including the control of bleeding by digital pressure and tourniquet, methods of administering artificial respiration, transportation of the wounded, the dressing of burns and minor wounds, and other procedures now so widely stressed in first aid programs. This film does an admirable job of presenting in an understandable way many of the more important first aid procedures. Preview audiences voiced the opinion that this film could be used most effectively with students completing first aid courses under an instructor, the picture serving as an actual demonstration of first aid procedures as practised by trained workers. The film may be shown as a whole or in parts. Information concerning prints may be obtained from the Red Cross National Headquarters in Washington, D. C., or from local chapters.

"HEALTH IN A PACKET"

Dr. C.-E. A. Winslow, of the Yale Department of Public Health, once said: "The discovery of popular education as an instrument of preventive medicine . . . has proved as far-reaching in its results as the discovery of the germ theory of disease." Remembering this and, mindful that the health of the entire population, not just the military, is essential to national defense, even in wartime, the Health Education Section of the Council of Social Agencies of Los Angeles last year set out to acquaint the public with available health education material.

This Section, a part of the Health Division of the Council, undertook the task of assembling and effecting the distribution of the best of authoritative information covering the major field of health. The Section, consisting of a carefully selected committee of lay and

professional leaders, gathered samples of printed material, lists of motion pictures, speakers, exhibits, and posters on (1) general health, (2) maternal and child hygiene, (3) social hygiene, (4) mouth hygiene, (5) tuberculosis, and (6) other specific diseases. Individual specialists in the group studied this material and selected the best for inclusion in a large packet called "Your Health." Samples of literature and lists of additional publications, speakers, films, and exhibits were placed in separate 8" by 10" envelopes under the six titles mentioned above. Each subdividing envelope, printed in two colors, carried a line drawing suggesting its contents and a list of the material enclosed.

The educational systems of the community were the most logical channels for distribution. A packet was supplied to the Health Coördinator in each of the high schools of Los Angeles to provide ready reference on material available for health programs in the schools. Since the home plays an equally important rôle in the health education of children, the packets were supplied to the health chairmen of approximately 200 Parent-Teacher Associations in the areas served by the Council of Social Agencies. One health worker remarked after viewing the packet that the Parent-Teacher Associations had in the packet the basis for a five year program on health. Because the Parent-Teacher Associations do not include as many fathers as mothers, the Section made packets available to the health committee chairmen of the major men's service clubs, and special libraries have been given packets for deposit in their reference material on health.

The packets include, in addition to samples, lists and similar material, a simple explanation of where and how pamphlets, films, posters, exhibits, and speakers may be obtained by any group in the community.

Approximately 500 copies each of the pamphlets included were donated by health and medical agencies and insurance companies.

THREE ANNUAL REPORTS

Annual reports that hold the reader's attention from cover to cover are indeed noteworthy editorial achievements. Such a report comes from the Commonwealth Fund, and if you have not yet read this agency's account of its 1941 activities, we urge you to do so. Here is a purposeful, carefully planned, and skillfully written report that succeeds remarkably well in describing the scope of the agency's work. Of special interest are those sections of the report dealing with the peculiar rural health problems which the Fund staff has done so much to solve. The final section of the report—entitled, "Saturday Morning"—creates a vivid and dramatic picture of the daily work of a county health department. One detects the rare editorial ability of Geddes Smith, of the Fund staff, throughout the 1941 report. It is a most commendable job.

Another unusually good annual report is that of the National Foundation for Infantile Paralysis, Incorporated. A very detailed account of the 1941 program is presented with pertinent facts and figures on all phases of the Foundation's work. It is interesting to note the expansion of the Foundation's educational program, which now includes grants for professional and popular educational materials, including pamphlets, periodicals, and films. This well documented report is neatly arranged, both as to layout and typography.

The Queensboro Tuberculosis and Health Association of Jamaica, N. Y., is to be congratulated on its 1941 report entitled "Three Fourths of the Way." An exceedingly simple, though pleasing, cover and distinctive stylized illustrations set this report apart from the usual run of annual statements. This report also reveals a splendid record of service

in many types of community health work.

JOTTINGS

In a recent issue of "Credit Lines" attention was called to the health exhibits at the Smithsonian Institution in Washington, D. C. It was pointed out that these exhibits have long been on display and that certain of them could probably be improved and modernized. It is good news to learn that something is being done in this direction by the Museum authorities, with the coöperation of the National Health Council and the U. S. Public Health Service. . . . A tip on titles: "An appropriate, interesting title for a health booklet is just as important as a good headline on an advertisement. Perhaps even more so. In the case of the advertisement, the eye may see some of the rest of the message in spite of the headline. But if the booklet title sounds dull and dry, the cover page may never be turned. One important consideration in framing a title is the idea of personalized treatment—getting in the 'you' element. The 'you' headline has won definite acceptance as one of the best approaches in advertisements." . . . Two books you will want to read: (1) *Let There Be Mercy*, by John Maloney, and (2) *This Chemical Age*, by William Haynes. The former relates the experiences of a special observer who visited the war-torn countries of Europe to survey and report upon the tragic conditions found there. This story will make every American proud of the part our Red Cross is playing in alleviating human misery. The latter book recounts the wondrous accomplishments of modern chemistry and shows how this science affects our comfort, health, and safety. . . . Observations from Reba F. Harris, Associate Director, Bureau of Public Health Education, Kentucky State Department of Health, on films: "Very few health films really meet the needs of rural areas, particularly in the South. Yet we find, I believe, a greater use of such films in the smaller communities. One of my main objections to so many of our health films is that the films have been devoted to diseases, rather than to the total living process of human beings. In other words, we have placed the emphasis on the germ and the transmission of the disease and yet we have not shown the effects of this disease on the family and family living, nor the relationship of this family with this disease to the community in which they live. I think there is a definite need for this type of health film, particularly in the South." . . . Homer N. Calver of the American Museum of Health reports a simple method of making paper charts translucent. To the back cover of unmounted charts, apply melted camphor ice. Press this into the paper or cloth mounting of the chart with an electric iron and wipe off the excess camphor. The chart is thus made translucent, may be mounted between glass, and may be illuminated from behind by fluorescent light. The process is adaptable to all types of charts, though it is recommended that before expensive charts are treated in this manner the paper or cloth of the same type used in the chart be experimentally treated. . . . Responses to the appeal for slogans are still coming in. Dr. Lester Breslow of the Rochester, Minnesota, Health Unit submits the following: "A Healthy Nation Today—A Healthy World Tomorrow."

BOOKS AND REPORTS

The Anaerobic Bacteria and Their Activities in Nature and Disease. (A Subject Bibliography.)—*By L. S. McClung and Elizabeth McCoy. Supplement I Literature for 1938 and 1939. Berkeley and Los Angeles: University of California Press,* 1941. 244 pp. Price, $3.50.

Two volumes under the above main title first appeared in 1939, presenting approximately 120,000 entries of about 10,500 original journal articles, monographs, and other published reports, for a period of 122 years from 1816 to 1938. Volume I gave a chronological index of authors, a subject index outline with page references to Volume II, and a valuable list of abbreviations used in citing periodical references.

Volume II was arranged by subjects, the main headings being habitat, culture methods, morphology, metabolism, products of metabolism, physiology, serological studies, disease relation, classifications, and special lists, each of these being again subdivided for chronological listing. Each reference gave the author's name, his initials, the journal, volume, inclusive paging, and year, but not the title, making it necessary to refer back to Volume I to find the title of each article. This made the use of the bibliography a little cumbersome.

These criticisms are avoided in Supplement I by the inclusion of titles after the authors' names, a distinct improvement.

The same general plan is followed as in the original set, Preface, Instructions to Users, Subject Index Outline, Key to Abbreviations of Names of Journals, Section I Chronological List of References (corresponding to Volume I as published in 1939), and Section II Subject Index Sections, List of Species of Anaerobic Bacteria, and Index (corresponding to Volume II as published in 1939).

Section I contains a total of 2,685 entries distributed as follows:

1938.....	1,231 entries	
1939.....	1,057 entries	
1940.....	397 entries	(incomplete)

The external form and binding of the Supplement are identical with those of the original volumes and maintain the usual high standards of the University of California Press.

IVAN C. HALL

About Ourselves—*By James G. Needham. Lancaster, Pa.: Cattell Press,* 1941. 276 pp. Price, $3.00.

In 1914 and again in 1939 we were tragically reminded that it is possible for civilized man to revert to his primitive state. The author of this book, a biologist, who also has delved into the development of man's social life, shows us that man is so much animal that for him war appears to be inevitable.

This book is written by a biologist, after many years in the laboratory and field, who has the gift of simplification that appeals to the layman. He treats of man in his biological aspects, showing that in development, structure, and function he is very much like the animal. The "brain is the chiefest of the gifts of the gods to our species" but we find it difficult to control. The driving forces in ourselves are the physiological responses necessary to keep life going. Instincts, such as fear and the preservation of the race, are deep springs of conduct derived from animals. In our social life are folkways that also have come in part from animals and are foundation stones in the social order. Ordinarily reason controls our social order but tribal instincts within and

without nations cause antagonistic groups to fight, impulses and passions become overpowering.

At the close of the book we find that religion in society is a stabilizing influence. "Government drives and organizes; religion leads and sustains."

The book has deservedly received much favorable commendation.

EDWARD C. SCHNEIDER

The Man Who Lived for Tomorrow—*By Wade W. Oliver, New York: Dutton,* 1941. 507 pp. Price, $3.75.

This book is marked "a biography of William Hallock Park, M.D.," but a careful and eager perusal reveals that it is both more and less. On the positive side may be counted (1) a beautifully written history of diphtheria, and (2) a somewhat less impassionate account of the development of the Bureau of Laboratories of New York City's Health Department. On the negative side there is too little of the man and practically nothing of tomorrow, both of which are disappointing. One might have expected that an eminent scientist with poetical instincts (and there is only one Wade Oliver) would get around to the future in a nice flambouyant style, but one fears that his immersion in a Victorian biography may have clouded his prophetic field of vision. In most spots this volume is a mixture of worshipful and dekruifian (and why not a useful word by now?) science. William H. Park was pretty much of a human being—what a pity that realistic biographies must always be written so long after a man that what appears to be realism is only conjecture.

No review for readers of this *Journal* needs to list the magnificent accomplishments of Park, for he is a part of our times and his life is, and must remain, one of the strongest and most enduring pillars of American public health. Perhaps not to be credited with the greatest discoveries of his time, he nevertheless possessed the courage to apply the findings of others to everyday public health—and this courage is possessed by few. Along with this courage he had the curious ability to endow all of those in his group with the type of zeal that was almost fanatical in character. One might suppose that few leaders in public health have been worshipped as absolutely as was William H. Park. The reader may search in vain in this biography for any explanation of this peculiar trait.

Oliver has omitted many things and perhaps for good reasons, but he might well have stated the part played by Park in the activities of various professional societies and in the shaping of public health standards, for these facts would have been more worth while than some of the bickerings which are included.

This is indeed a handsome book, beautifully written and beautifully manufactured. KENNETH GOODNER

Cases of Syphilis Under Treatment—Cuyahoga County—March, 1940—*By Howard Whipple Green. Published by Joint Social Hygiene Committee of the Academy of Medicine of Cleveland and The Cleveland Health Council,* 1941. 51 pp.

This is the third annual report in which cases of syphilis under treatment in Cuyahoga County (Cleveland, Ohio) during a given month are analyzed. The data are of significance mainly in relationship to those for the two preceding years.

There were 3.3 cases per 1,000 population under treatment in March, 1940, as compared with 3.8 per 1,000 in March, 1938. The rate for whites was 2.0 per 1,000 and for colored 20.6 per 1,000. Infectious cases comprised 9 per cent of the white cases and 26 per cent of the colored. The number of infectious cases decreased in whites

from 344 in 1938, to 205 in 1940, but increased in colored persons from 330 in 1938, to 441 in 1940. For the month of March, however, the number of new infectious cases among white and colored together was 181 in 1938, 161 in 1939, and 91 in 1940.

These and other data have been analyzed according to race, sex, age, and treating agency. To what extent the figures reflect real changes in the attack rate of syphilis in Cleveland is difficult to say, but it is from this type of painstaking analysis of the available data year after year that reliable evidence regarding the trend of syphilis is likely to come.

THOMAS B. TURNER

Twelve Months of Health Defense —*Edited by Savel Zimand. Annual Report of the Department of Health, City of New York,* 1940. 283 pp. Price, $1.00.

This is an account of the activities of the Health Department of New York City for 1940 together with comparative tables on vital statistics and a review of developments since 1934. Inside the front and back covers are effective two page charts which show since 1900, the annual death rates per 1,000 population according to age groups. More detailed subsequent analysis under a heading—The Changing Picture—reveals for this city of some 7½ million persons a death rate in 1940 of 45.7 for the pneumonias, 44.5 for pulmonary tuberculosis, 3.3 for "cholera infantum," as contrasted with rates in 1901 of 258, 228.9, and 164.1, respectively. There were only 10 deaths from diphtheria in 1940 against 2,068 in 1901 when the population was less than half as large.

The death rate in 1940 from diseases of the heart was over 3 times that of 1901, while that from cancer was over 2¼ times as high as in the earlier year, illustrating factors accompanying the aging of the population. The decline of infant mortality to 35 per 1,000 live births and the control of acute communicable diseases represent great public health victories. But, as stated in the report, cancer, diabetes, and diseases of the cardiovascular renal group, charged with less than 25 per cent of the mortality in 1901, are now responsible for more than 65 per cent of all deaths in the city. "Some of the increase in these diseases, to be sure, is also due to improved diagnosis. Nevertheless the public health program of the future will undoubtedly have to concern itself more with these three causes of disability and death."

Under "Seven Years of Progress" reference is made to one of the major achievements—the development of the district health center plan with a unit of department workers and services in the 30 districts of the city, each with a population of about 250,000. Other developments have included a vigorous campaign for the control of syphilis and gonorrhea, mass x-ray surveys to discover tuberculosis, reaching over 303,000 persons (with the death rate reduced by 25 per cent), the conduct of important studies, personnel training through experimental teaching centers and in-training courses, and recent necessary shifts in emphasis to meet emergency conditions.

While the statistical information in the report is extensive, much of the "meat" is presented in a concise and interesting manner in the descriptive text accompanied by 25 effective photographic illustrations of the department in action. Human interest is also added by brief quotations and lively descriptions from the service in the field and health center. Reference to specific subjects is facilitated by a carefully prepared index and a table of contents, the latter carrying among the titles: health defenses, human bookkeeping and health education, centers of public

health, and sanitary protection; and subtitles: the library with the children (referring to the child hygiene services, a pioneer organization developed in 1908), and so to school, the laboratory shows the way, our sanitary corps, and guarding the home front. The last title refers to the 900 public health nurses who every day of the year in clinics, at schools, and in homes, come directly and intimately into contact with the people. This is a stimulating report of progress, carefully planned and ably executed. IRA V. HISCOCK

The Volunteer in Public Health Nursing — *Prepared by Evelyn K. Davis. New York: National Organization for Public Health Nursing,* 1941. 48 pp. Price, $.50.

The *Volunteer in Public Health Nursing* should be on the desk of every director of a nursing agency and available to her staff members as well as to her board members and volunteers.

This handbook was prepared by Evelyn K. Davis, formerly assistant director of the National Organization for Public Health Nursing and now with the office of Civilian Defense for New England. She has had long experience in work with the lay person and the manual is the result of her many contacts over the country with people who want to help in the health field but lack medical or nursing training.

Miss Davis with great clarity explains why a nursing organization should use the volunteer, and where she can be made useful "so to assist the nurse that her services will go further in the community." She believes that, "a volunteer carefully selected, trained, and supervised may be made to feel a part of the organization."

A very explicit schedule of actual work in clinics, motor corps, etc., has been worked out, and directions for selection, training, and placement of volunteers will serve as a guide in the use of a layman for any size organization. The handbook is equally important for the staff member and the student nurse as it is only their understanding of the place of the volunteer in their public health program that can make a volunteer feel part of it all.

Today, more than ever before, the appeal from all types of people is "what can I do to help in the Civilian Defense Program?" As health work is recognized as the first line of defense in this World War II, I feel that this handbook provides the answer and offers adequate solution to that question. Miss Davis's book is so full of suggestions that any director who works with volunteers whether it be in a health or a welfare agency could well afford to consult it. PRISCILLA K. THAXTER

Toughen Up, America — *By Dr. Victor G. Heiser. New York: McGraw-Hill,* 1941. 228 pp. Price, $2.00.

Dr. Heiser's book of reminiscences, *An American Doctor's Odyssey,* had a well deserved success and gave an interesting picture of the work of a public health physician. *Toughen Up, America* deals with personal hygiene and as the title indicates is hitched to propaganda, with a not very happy result. All writers on personal hygiene are, by the nature of the case, platitudinous but few have achieved such a masterpiece of linked dullness, long drawn out, as Dr. Heiser.

The chapter openings are beacons for all future popular health writers to avoid. "Few of us escape a moment of sharp realization that we must do something about our diet." "Very few of us reach maturity without some period of sleeplessness." "We are a queer lot, we humans." Charity demands that a veil be drawn over other evidence of how banal a civilized man can be when he takes pen in hand and lets his wits drift out of the window.

Dr. Heiser records as a solemn contribution to the science of hygiene that

a doctor in Carlsbad told him, "Your skin is yellow. You have colitis." If that is typical of the medicine they practised in Carlsbad, it is well Carlsbad *delenda est. Toughen Up, America* has softened down Dr. Heiser.

LOGAN CLENDENING

Microbes Which Help or Destroy Us—*By Paul W. Allen, Ph.D., D. Frank Holtman, Ph.D., and Louise Allen McBee, M.S. St. Louis: Mosby,* 1941. 540 pp. Price, $3.50.

This volume is evidently issued for popular consumption, but one may question its ultimate popularity, for it is too carefully written and too accurately detailed to make vivid reading. The list of subjects covered is truly amazing for a volume of only 540 pages. Practically all infectious diseases, as well as bread making, vinegar, evaporated milk, and manure, are included. One might suggest that there is some lack of balance in the treatment of various subjects and some unevenness in the amount of color found in the test. It is rather a shock to find a popular book which has avoided the journalistic style of presentation.

The volume is set in the usual clear Mosby style but the larger part is printed on a glazed paper with a greenish tint which is supposed to make reading easier but which to this reviewer is very disagreeable. Nevertheless, the volume is commendably accurate.

KENNETH GOODNER

Preeclamptic and Eclamptic Toxemia of Pregnancy—*By Lewis Dexter and Soma Weiss. Boston: Little, Brown,* 1941. 414 pp. Price, $5.00.

This attractive volume represents a successful attempt to summarize and bring up to date our present knowledge of the toxemias of late pregnancy. It further includes a large amount of pertinent investigation on the part of the authors themselves. The book differs from previous works on the subject in that it is written by and presents the point of view of the internist rather than the obstetrician. Particularly to be commended is the chapter on the nature and significance of generalized edema in normal and toxemic pregnancy. There is also a precise and impartial summary of the work which has been done in an effort to correlate endocrine imbalance with the various manifestations of toxemia. Proper emphasis is placed on prophylaxis or adequate prenatal care, on the early treatment of toxemia, and on the importance of termination of pregnancy if improvement does not soon appear. On the debit side one might wish for a more liberal presentation of the various types of modern treatment, and particularly of eclampsia. Also more space might well have been allotted to the remote effects of the toxemias as related to chronic vascular disease and in this regard many authorities will probably deprecate the section on prepregnant hypertension uninfluenced by pregnancy, a phenomenon which, in the experience of the reviewer, is very rarely seen. The book is to be recommended for the investigator and specialist but is doubtless not intended for the average student or practitioner.

CHARLES H. PECKHAM

We Need Vitamins—*By Walter H. Eddy and G. G. Hawley. New York: Reinhold,* 1941. 102 pp. Price, $1.50.

This book is without doubt one of the best written, concise and informative books for the laymen and nonnutritionists that have yet been published. It can be read in a few hours or in a couple of evenings. The information is accurate, up-to-date, and yet written in non-technical language which the average lay person can fully understand. Much of the text is in narrative form, that is, questions and answers, and this aids much in reliev-

ing the usual monotony of perusing scientific or technical books.

The appendix contains a very useful table of vitamin content of foodstuffs. Instead of confounding the reader by referring to half a dozen different vitamin units, the authors are very careful to give unit equivalents in every case. They also give values for the average serving. This information is of particular value to dieticians. The reviewer highly recommends this little book. It is literally packed with vitamins.

C. R. FELLERS

Immunization to Typhoid Fever—*By Colonel J. F. Siler and others. The American Journal of Hygiene Monographic Series, No. 17. Baltimore: Johns Hopkins Press,* 1941. 276 pp. Price, $2.50.

This comprehensive report of seven years' experimental investigation by scientists of the United States Army Medical School research laboratories is an outstanding contribution to our knowledge of immunization against typhoid fever.

After a historical review of results in the preventive programs of the Army, Navy, and Civilian Conservation Corps, the authors present their experimental studies on the influence of antigenic structure of *Eberthella typhosus* used for vaccine preparation in the production of immunity as measured by mouse protection tests. This is followed by observations on the duration of immunity and on methods of revaccination. Each phase of the investigation is discussed in detail and results are presented in a logical and orderly manner well documented with tables, sample protocols, and a series of appendices explaining details not given in the main text. The authors, in summarizing their findings, lay down criteria for selection of strains to be used for vaccine preparation and for keeping such strains in suitable condition. They recommend a continuance of the standard three dose method for initial immunization but prefer a single dose intracutaneous method for reimmunization.

There is need for more such critical studies of methods in public health practice and it is pleasant to record that the authors indicate that these investigations are to be continued by similar studies on immunization against paratyphoid fevers and consideration of problems of cross-immunization.

E. K. KLINE

BOOKS RECEIVED

FATIGUE OF WORKERS. Its Relation to Industrial Production. By Committee on Work in Industry of the National Research Council. New York: Reinhold, 1941. 165 pp. Price, $2.50.

MODERN SANITARY ENGINEERING. By G. Eric Mitchell. Brooklyn: Chemical Publishing, 1941. 169 pp. Price, $5.00.

THE DOCTORS MAYO. By H. B. Clapesattle. Minneapolis: University of Minnesota Press, 1941. 822 pp. Price, $3.75.

WATER PURIFICATION FOR PLANT OPERATORS. By George D. Norcom and Kenneth W. Brown. New York: McGraw-Hill, 1942. 180 pp. Price, $2.50.

FOUR TREATISES BY PARACELSUS. Edited by Henry E. Sigerist. Baltimore: Johns Hopkins, 1941. 256 pp. Price, $3.00.

EVERYDAY NURSING FOR THE EVERYDAY HOME. By Elinor E. Norlin and Bessie Donaldson. New York: Macmillan, 1942. 306 pp. Price, $2.50.

SO BUILD WE. By Mary S. Gardner. New York: Macmillan, 1942. 223 pp. Price, $2.25.

THE BLOOD BANK AND THE TECHNIQUE AND THERAPEUTICS OF TRANSFUSIONS. By Robert A. Kilduffe and Michael DeBakey. St. Louis: Mosby, 1942. 558 pp. Price, $7.50.

INTELLIGENCE, POWER AND PERSONALITY. By George Crile. New York: McGraw-Hill, 1941. 347 pp. Price, $3.00.

PRE-NATAL CARE FOR FATHERS. By John Gould. Brattleboro: Stephen Daye Press, 1941. 70 pp. Price, $1.50.

A SELECTED PUBLIC HEALTH BIBLIOGRAPHY WITH ANNOTATIONS

RAYMOND S. PATTERSON, PH.D.

Be Prepared—Read this editorial (and some of the references) about *C. diphtheriae* gravis, the deadly form that kills despite immune serum. Except recently, in Halifax, this type hasn't made headway on this continent. But under war time conditions who can foretell when it will?

ANON. Newer Knowledge of Diphtheria Gravis. J.A.M.A. 118, 5:380 (Jan. 31), 1942.

Our Gory-ous Fourth—More evidence is offered through this annual compilation that legislation plus effective enforcement will reduce deaths and injuries from fireworks. The nationwide total declined handsomely in 1941, but if states which haven't them, would enact effective laws, and some other states would enforce the ones they have, the good record might be further improved.

ANON. Fifth Annual Summary of Fourth of July Injuries. J.A.M.A. 118, 1:46 (Jan. 3), 1942.

Department of Human Genetics—As generation of Yale students follows generation they enter younger and are heavier and taller. Half a century ago one student in 20 was over 6 feet tall. Today the 6 footers are 1 in every 5. Physicians, sanitarians, nutritionists, educators all may lay some claim to sharing in this phenomenon.

DEEGAN, W. A Firty-nine Year Survey at Yale Reveals Freshmen Are Becoming Younger, Heavier, and Taller. Research Quart. 12, 4:707 (Dec.), 1941.

More Than Medicine is Needed—Intimate exposure and poverty are the two conditions that most favor tuberculosis. Where they meet, double protection is needed and this implies more than free medical care and treatment. These wise words from one of our late and great public health statesmen are given new meaning by this Harlem study.

DOWNES, J., and PRICE, C. R. The Importance of Family Problems in the Control of Tuberculosis. Milbank Quart. 20, 1:7 (Jan.), 1942.

Tuberculosis-Saboteur — In the Navy the incidence of tuberculosis is not high, and the thorough methods employed to exclude tuberculous recruits will result in a continued decline of the disease. Fluorography with the 35mm. film is used, with a standard film retake for checking questionable cases. Tuberculosis in veterans, having cost the country a cool billion since the World War, is also a matter of concern to the Army. Draftees, generally, will have chest fluorographic examination using the 4″ x 5″ film.

DUNCAN, R. E. Pulmonary Tuberculosis (and) POLLOCK, W. C. Tuberculosis in the Army. Am. Rev. Tuberc. 44, 6:651 (Dec.), 1941.

Diet Does It—Diets of 400 women during their prenatal period were recorded. Some on poor diets were allowed to go on as controls. Others, previously poorly nourished, had their poor diets supplemented. Still others, already on good diets, were helped by education. Those on good or supplemented diets had fewer complications, were better obstetrical risks, had fewer miscarriages, stillbirths, and premature births than those on poor diets, and among the resulting infants there were fewer illnesses and deaths. This excel-

lent paper will well repay study. Don't be satisfied with this inadequate note upon it.

EBBS, J. H., *et al.* The Influence of Prenatal Diet on the Mother and Child. Milbank Quart. 20, 1:35 (Jan.), 1942.

Which Tuberculin Test?—For case finding surveys, the patch test may prove more efficient than the intracutaneous test, if the well known loss from needle shyness is taken into account; so concludes this painstaking study.

FURCOLOW, M. L. Quantitative Studies of the Tuberculin Reaction. Pub. Health Rep. 56, 51:2405 (Dec. 19), 1941.

Prepared for Polio—For a good, workman-like report of a well conceived control project to deal with an anticipated outbreak of poliomyelitis, I suggest you write for the issue of the Maryland bulletin named below. With federal aid, the health officers aimed to secure immediate and complete reporting, early hospital, or supervised home care, and competent after-care, and these aims must have been very largely achieved.

HALLIDAY, C. H. Poliomyelitis Situation in Maryland. Maryland State Dept. of Health Monthly Bull. 13, 9:77 (Nov.), 1941.

Germs on Lip of the Cup—Ignorance of sanitary procedures by managers and employees appears to be the chief cause of insanitary practices. It seems that the health engineering profession (in the city studied, at least) is not utilizing education as a tool to improve public eating and drinking places. This is the inescapable conclusion of a (Providence, R. I.) bacteriologic sampling of silver and glassware.

HORWOOD, M. P., and PESARE, P. J. The Sanitation and Bacteriology of Public Eating Utensils. Pub. Health Rep. 57, 2:33 (Jan. 9), 1942.

Encouragement for Oldsters—You will remember Osler's often misquoted crack about the unproductiveness of old-timers, even if you did not read an earlier study by the author of this paper which indicated that most creative thinking was done when the thinker was in his thirties. Now comes a study which indicates that the top of the political ladder (in any field, scientific as well as social) is most often reached by men in the late fifties.

LEHMAN, H. C. Optimum Ages for Eminent Leadership. Sci. Month. 54, 2:162 (Feb.), 1942.

Page Mrs. Sanger—Australia's long continued decline in fertility rates (the net reproduction rate has now sunk below the rate required for replacement) is evidence that declining fertility is a characteristic of new as well as old countries. It cannot be attributed to "militarism," or to democracy. Research is needed in causes and consequences.

MCCLEARY, G. F. Australia's Population Problem. Milbank Quart. 20, 1:23 (Jan.), 1942.

Note for School Medical People—Lethane in deodorized kerosene sprayed with a flit gun proves to be the most successful method of removing head lice in this Canadian experience. It is reported that no other treatment has been received with such gratification and enthusiasm by the parents.

MAC HAFFIE, L. P. Pediculosis—A New Treatment. Canad. Pub. Health J. 32, 12:606 (Dec.), 1941.

Diphtheria Carriers—Children with tonsils intact are more often carriers of diphtheria than are those who have had this lymphoid tissue removed. There is much more in this continuing exploration in an old field.

MAXCY, K. F., *et al.* Diphtheria in Baltimore: Tonsillectomies as Related to the Diph-

theria Carrier Rates. Am. J. Hyg. 35, 1:42 (Jan.), 1942.

Polio Flies—Here is more proof that house flies may carry poliomyelitis virus—this time from Cleveland and Atlanta.

SABIN, A. B., and WARD, R. Flies as Carriers of Poliomyelitis Virus in Urban Epidemics. Science 94, 2451:590 (Dec. 19), 1941.

Radiant Disinfection of Air—You will want to know about this study to test the hypothesis that epidemic contagion is spread in confined atmospheres and can be controlled by radiant disinfection. It seems too bad to spoil the story by telling the results, which did support the hypothesis. Measles epidemics were much reduced as compared with control rooms. Colds weren't helped—presumably because they are more often contracted in intimate outside contacts.

WELLS, W. F. The Environmental Control of Epidemic Contagion. Am. J. Hyg. 35, 1:97 (Jan.), 1942.

Air, Vapor, and Oral Mucosa—Health educators sometimes talk pretty glibly about our over-heated homes, the kiln-dried air therein, the arid nasal mucosa, and the resulting colds we enjoy. A survey of the factual data presented in this excellent paper will tend to make such hygienic pronouncements a little less pontifical.

WINSLOW, C.-E. A., *et al.* The Influence of Atmospheric Temperature and Humidity upon the Dryness of the Oral Mucosa. Am. J. Hyg. 35, 1:27 (Jan.), 1942.

ASSOCIATION NEWS

SEVENTY-FIRST ANNUAL MEETING

ST. LOUIS, MO., OCTOBER 27–30, 1942

Headquarters

MUNICIPAL AUDITORIUM

APPLICANTS FOR MEMBERSHIP

The following individuals have applied for membership in the Association. They have requested affiliation with the sections indicated.

Health Officers Section

Oswald De N. Cammann, M.D., New Canaan, Conn., Health Officer

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Irwin Rothman, V.M.D., 2233 N. 18th St., Philadelphia, Pa., Veterinarian, U. S. Dept. of Agriculture

DECEASED MEMBERS

Justus Goslau, M.D., Cedar Grove, N. J., Elected Member 1938, Laboratory Section

Clifford B. Line, D.V.M., Lansing, Mich., Elected Member 1940, Laboratory Section

EMPLOYMENT SERVICE

The Association Employment Service seeks to bring to the attention of appointing officers the names of qualified public health personnel and to act as a clearing house on employment. This is a service of the Association conducted without expense to the employer or employee.

From the registry of persons available, selected announcements are published from time to time. Appointing officers may obtain lists of all registrants on request.

U. S. Civil Service Commission

The U. S. Civil Service Commission, Washington, D. C., announces unassembled examinations for Home Economists in 5 different grades at $2,600 to $5,600 a year. Interested persons should apply to the Commission for **Circular 195** on Home Economics.

Junior Public Health Nurse. A civil service examination for Public Health Nurse ($2,000) has been open for some time. Nurses who have been unable to qualify for this examination because of the experience requirement now have an opportunity to qualify through a new Junior Public Health Nurse examination ($1,800) which requires no experience. Applications are also being received for examinations now open for Junior Graduate Nurse ($1,620) and Graduate Nurse for general staff duty ($1,800). Further information and application forms may be obtained at any first or second class post office or from the Civil Service Commission, Washington.

Positions Available

County Public Health Nurses for New Mexico. Must have four months' post-graduate instruction under one of the recognized public health nursing courses and one year's experience. Must drive and have a car. Address inquiry to State Health Department, Santa Fe, N. M.

Physician with either public health training or experience in local health department administration to serve as health director in a county health department in mid-western state. Salary $4,000 and $500 travel (flat rate). Well established department with offices in attractive little city of 10,000. Write **Box T**, Employment Service, A.P.H.A.

Wanted: Trained Public Health Nurse, starting salary $1,500 per year and traveling expense, increase to $1,700 within 6 months. Saginaw County Health Department, Saginaw, Mich.

The State Department of Social Security and Welfare, Crippled Children's Division, of Phoenix, Ariz., has three vacancies to be filled. Examinations will soon be held for orthopedic nursing consultant, nurse-physical therapist, and medical social worker.

Further information may be obtained by writing to the Merit System Supervisor, Room 208, 128 North First Avenue, Phoenix, Arizona.

Physicians Wanted in Cincinnati

Carl A. Wilzbach, M.D., Commissioner of Health of Cincinnati, has announced that there are vacancies for white male physicians, aged 23 to 50, graduates of recognized colleges of medicine, licensed to practise in Ohio, for appointment to the Cincinnati Health Department. Duties include surveillance over communicable disease, infant and child welfare work, medical service for sick poor, epidemiological surveys of communicable disease, examinations for work certificates, school teachers, etc., vaccination, medical school inspection. Salary $2,640 to $3,360 plus transportation allowance of $240 per annum. Eligible for a retirement system. Persons interested should communicate with Dr. Wilzbach, Commissioner of Health, City Hall, Cincinnati, Ohio.

Public Health Engineer

Responsible professional public health engineering involving field investigations and office studies in the application of sanitary measures. The more difficult engineering and sanitation field surveys include supervision over public water supplies, sewerage systems and sewage treatment plants and review of plans for same, and promotion and supervision of sanitation programs. Minimum qualifications: Training and experience equivalent to 3 years' civil engineering experience, including 2 years in public health or sanitary engineering; *or* completion of an academic year of g duate study and a year's experience in sanitary or public health engineering; *and* graduation from a college of recognized standing with a major course in civil or sanitary engineering. The salary range is $205 to $250 per

month depending upon experience. Apply **Box E,** Employment Service, A.P.H.A.

Southwestern State Health Department seeks 2 physicians for assignment to district health units, personally to conduct several small venereal disease clinics on a rotating schedule. Experience preferred but not required. Salary $3,000, plus actual travel allowance not to exceed $1,200. Write **Box V,** Employment Service, A.P.H.A.

Middle western city, 125,000 population, seeks well trained and experienced Health Officer on full-time, with competence to administer a department and teach public health to medical students. Salary $5,000 to $5,500 per annum. Write **Box K,** Employment Service, A.P.H.A.

Bacteriologist, M.S. or Ph.D., with 3–5 years' applied experience in the field of sanitation and disinfection, wanted by prominent eastern manufacturer for research and development work. Creative ability must be established. Consideration will be given only to those who fully meet the above requirements. In replying give full academic, industrial and personal background. Transcript of academic record, scientific and personal references, and recent photograph will be requested. Write **Box P,** Employment Service, A.P.H.A.

The New Mexico State Department of Health will consider applications for the position of Assistant Director of the Maternal and Child Health Division and for Dental Health Consultant of that Division. Address inquiries to the State Department of Public Health, Santa Fe. N. M.

Instructor in Bacteriology, Medical School, large midwestern university. M.D. (or Ph.D. or D.Sc. in Bacteriology); Male. Salary $1,800 to $2,500 according to age and experience. Write **Box D,** Employment Service, A.P.H.A.

POSITIONS WANTED

ADMINISTRATIVE

Teaching or administrative position desired by physician, aged 48. Experienced teacher in preventive medicine and public health, now employed at prominent medical school. Twenty years' experience in municipal health administration and epidemiology. **A–491.**

Physician, M.D. Tulane, M.P.H. Johns Hopkins, age 31, experienced as health unit director, prefers administrative position in the South. **A–488**

Physician, age 32, 5 years clinical and administrative experience in venereal diseases, wishes administrative position in venereal disease control, preferably at state level. **A-490**

HEALTH EDUCATION

Teacher and research worker, man, Ph.D., age 52. Extensive record as college professor of biology and hygiene and investigator, for the past two years engaged in research. **H–499**

Health Educator, Negro, man with background of High School administration and M.S.P.H. from Michigan, seeks position in Health Education. Public agency or educational field. Excellent references. **H–497**

Woman, M.S. in public health, excellent graduate training in education, 8 years' experience as business executive (sales and publicity). Just completed year's research in community education. Seeks good administrative position. **H–496**

Health Educator, M.A. in Education, 10 years' background in community organization for public health education, also teaching of personal and community health at high school and college levels. Public health nurse, able to teach mental and social hygiene as well as general health education. East preferred. **H–498**

Health Educator. Man with M.S. in preventive medicine and public health. Negro. Seeks position in Health Education or field work with official or nonofficial agency. **H–500**

Woman with master's degree in health education, 12 years' successful experience in public school and college teaching, administration and research. Will consider position in normal school, public schools, or in official or nonofficial health agencies. Prefers South or East. Available at once. **H–501**

LABORATORY

Milk Sanitarian and Technologist, age 37, Ph.D. Bacteriology, Wisconsin, 10 years' experience in milk and food sanitation from industrial and official angle, seeks administrative position with opportunity for research or investigational work preferred. **L–381**

Chemist, Sc.D., Biochemistry, Johns Hopkins University. Age 31. Public health laboratory experience, teaching experience. Desires position with promise of advancement, preferably in commercial organization. **L–461**

Bacteriologist, young man, 28, with B.S. in industrial science, experienced in newspaper work, salesmanship and now employed in a state department of health laboratory, seeks position as bacteriologist or doing promotional work of public health nature. **L–465**

SANITARY ENGINEERING

Public Health Engineer, M.S. Harvard, experienced in public health and industrial hygiene, wishes position of better sort in public health engineering or industrial hygiene. **E–470**

STATISTICAL

Woman with academic, business and research experience in vital statistics, seeks a position in the vital statistics division of a state or city health department, preferably as registrar. **S–459**

Experienced and well trained public health nurse, with background of tuberculosis, venereal disease, school, industrial, and generalized srevices, will shortly be available for appointment. Three years as director of state nursing service. Experienced as university teacher of public health nursing. M.A., New York University. **M–449**

Advertisement

Opportunities Available

PUBLIC HEALTH PHYSICIANS—(a) City health officer; college and industrial town of 25,000; woman physician eligible; around $4,000. (b) County health officer; opportunity for extensive private practice in rural area; estimated monthly income, around $500; Washington State. (c) Field epidemiologist, division of venereal disease control; eastern state. (d) County health director; special public health training not required; $4,600, including automobile allowance; Oklahoma. (e) Assistant director, division of maternal and child health; postgraduate training obstetrics required; woman physician eligible; West. (f) City-county physician; full-time appointment in fairly large town; Georgia. PH3–1, Medical Bureau (Burneice Larson, Director) Palmolive Building, Chicago.

PUBLIC HEALTH NURSES—(a) Public health nurse with background of experience in tuberculosis nursing to carry on tuberculosis control work; county appointment; $150, transportation in county car furnished; Pacific Coast. (b) For appointment in clinic of 300 bed hospital; duties will include supervision of student nurses giving visiting nurses' service in homes; South. (c) County health appointment; duties include general public health nursing, some obstetrical delivery service, small amount of social service work; Midwest. (d) Assistant supervisor of school nurses; supervision will extend to both educational and field work; $1,800, transportation allowance; headquarters will be in central city of 300,000. PH3–2, Medical Bureau (Burneice Larson, Director) Palmolive Building, Chicago.

BACTERIOLOGISTS — (a) Bacteriologist-serologist; excellent Chicago hospital; degree, personal interview required; $150, partial maintenance, increasing. (b) Junior bacteriologist for large hospital serving training camp; enthusiasm more important than extensive experience; around $1,500, traveling expenses to field. (c) Assistant bacteriologist-serologist, city laboratory; duties include assisting in serology, milk, water and restaurant bacteriology, general bacteriology; $1,500, to begin; ample opportunity for advancement; New York State. PH3–3, Medical Bureau (Burneice Larson, Director) Palmolive Building, Chicago.

Advertisement

Situations Wanted

INDUSTRIAL HYGIENIST—B.S., M.D., eastern schools; M.P.H., Harvard School of Public Health; municipal health physician, two years; several years, assistant director, state industrial hygiene bureau. PH3–4, Medical Bureau (Burneice Larson, Director) Palomolive Building, Chicago.

PUBLIC HEALTH PHYSICIAN—A.B., state university; M.D., Harvard; M.P.H., Johns Hopkins School of Hygiene and Public Health; graduate training in pediatrics before specializing in public health medicine; six years, assistant commissioner, metropolitan health department. PH3–5, Medical Bureau (Burneice Larson, Director) Palmolive Building, Chicago.

PUBLIC HEALTH NURSE—B.S. and M.S. degrees in administration in public health nursing, eastern university; active in public health administration for many years; keenly interested social problems; now educational director visiting nurse association. PH3–6, Medical Bureau (Burneice Larson, Director) Palmolive Building, Chicago.

BACTERIOLOGIST—Desires position, preferably in public health laboratories; B.A., eastern school; C.P.H. and Ph.D. (bacteriology), Yale University; has done considerable research; four years, bacteriologist and research technician, public health laboratories. PH3–7, Medical Bureau (Burneice Larson, Director) Palmolive Building, Chicago.

NEWS FROM THE FIELD

PUBLIC HEALTH NURSING IN HONOLULU EMERGENCY

SUPPLEMENTING the account carried in February *Journal* of the activities in the Territorial Board of Health during the recent emergency in Hawaii, Mary Williams, R.N., the Director of the Bureau of Public Health Nursing of the Territorial Board of Health, writes that the Board had long planned for essential health measures in an emergency and was in active service immediately. Prompt and efficient communicable disease control measures were instituted and every assistance in medical, sanitary, and nursing aid was given to the military and civil authorities.

"A number of Board of Health nurses got into active service the first few hours and days in hospitals and first-aid stations, but were released to their regular jobs as soon as possible. Perhaps one of our most important services was out in the field reassuring families and particularly maternity patients. Every one of these was visited, plans for delivery were checked, and provision made for hospital or home care. Nurses were on 24 hour call for any emergency home cases. We had the necessary official passes, automobiles, gasoline, and equipment to go anywhere. We were able to give assistance to the evacuees as families were moved immediately from danger zones and housed in public buildings. Subsequent evacuation orders in certain areas have continued this work."

WESTERN BRANCH, A.P.H.A., TO MEET IN SEATTLE

W. FORD HIGBY, Secretary of the Western Branch of the American Public Health Association, has announced that the Branch will meet in Seattle, May 26 to 29 inclusive, with headquarters at the Hotel Olympic. The first day, Tuesday, May 26, will be reserved for meetings of affiliated groups.

Dr. Adolph Weinzirl of the University of Oregon Medical School, Portland, is Chairman of the Program Committee.

COURSE OF LECTURE CONFERENCES ON HEALTH EDUCATION IN NEW YORK

THE Welfare Council of New York City through its Health Education Section has announced a course of lecture conferences on the scientific foundation of health education. The course is arranged for health educators of New York City by the Subcommittee on Scientific Sessions of the Health Education Section. Dr. Iago Galdston is Chairman, Hazel Corbin and Lucy Gillett are members of the committee.

The January lecture was by Dr. J. B. Youmans of Vanderbilt University Medical School, Nashville, Tenn., on Nutrition and Health Education. The February lecture was by Dr. John Romano of the Harvard Medical School, Boston, on Mental Hygiene.

The three forthcoming sessions are listed below. The conferences are to be held at the New York Academy of Medicine, 2 East 103rd Street, New York, N. Y., 3:30 to 5 P.M. on the dates indicated. Cards for admission to the series may be secured by addressing Dr. Galdston at the Welfare Council, 44 East 23rd Street, New York, N. Y.

March 25—Dr. Bernhard J. Stern, Department of Sociology, Columbia University, New York, N. Y.—Sociology.

April 30—Philip Lennen, President, Lennen & Mitchell, New York, N. Y.—Instrumentalities of Education and Propaganda.

May 28—Dr. Perrin Long, Johns Hopkins University, Baltimore, Md.—Hygiene—Public Health.

VITAMIN D VALUE OF SUNLIGHT IN VARIOUS CITIES

THE Wisconsin Alumni Research Foundation of Madison, Wis., announces the publication of a new chart entitled "Facts Regarding the Vitamin D Value of Sunlight in Your City." Concise information is available on clear days and hours of sunshine for each month for 67 cities in the United States. Single copies will be sent free upon request.

NATION-WIDE IMMUNIZATION CAMPAIGN

ELSEWHERE in this issue the Child Health Day proclamation by President Roosevelt focuses the attention of the public on the desirability of having all children in the United States immunized against smallpox and diphtheria. Sponsoring this campaign are the Conference of State and Provincial Health Authorities of North America and the Children's Bureau of the U. S. Department of Labor. The Office of Education, the Public Health Service and state and local health departments and the public schools throughout the nation are expected to coöperate. Main emphasis is placed upon diphtheria and smallpox but it is pointed out that physicians in some areas will also advise immunization of children against whooping cough, tetanus, or typhoid.

Pointing out that there were almost 17,000 cases of diphtheria in 1941, Dr. Martha M. Eliot, Associate Chief of the Children's Bureau, emphasized the fact that neglect of these life-saving preventive measures now takes a heavy toll in illness and death of children. Dr. Eliot expressed the opinion that only by continuing to apply our knowledge of vaccination can we prevent smallpox from returning in the form of virulent epidemics. She noted that in 1941 there were 1,368 reported cases of smallpox in the United States. Dr. Eliot referred to the widespread shifts of population that result from the mobilization of fighting men and of the labor army and which are apt to increase the hazards of disease. It is therefore more urgent than ever, she said, in this wartime period, and in view of the prospective shortage of doctors and nurses in many communities, to protect the army and industries from the dangers of these diseases so common among children.

The aim of the program is to extend the immunization to 100 per cent of children beyond 9 months of age by May 1, Child Health Day, 1942.

MEDICAL VISITORS FROM CHILE

NINETEEN Chilean physicians are in the United States visiting medical and public health facilities under the guidance of Dr. Hugh S. Cumming, the Director of the Pan American Sanitary Bureau, Washington.

Nine of these physicians have spent considerable time in Michigan as guests of the W. K. Kellogg Foundation, the Detroit Department of Health, and the University of Michigan. They have also visited the Board of Health of Chicago and have recently been to Cincinnati and Nashville. Their special interests are pediatrics, tuberculosis, and maternal health. They are health officers in their districts under the national insurance plan in Chile.

These men include:

Dr. Honorio Aguirre
Dr. Victor Sierra
Dr. Oscar Illanes
Dr. Jorge Abasolo
Dr. Manuel Marin
Dr. Pedro Martini
Dr. Raul Cantuarias
Dr. Luis A. Diaz
Dr. Gabriella Duco

HEALTH CONGRESS IN MEXICO

SCIENCE announces that the first Mexican Congress of Internal Medicine will be held in Mexico City from May 3 to 10, under the aus-

pices of the President of Mexico and the Departments of Education and Public Health, with the coöperation of the medical societies of Mexico and the National University.

DR. BAEHR APPOINTED TO HEALTH AND MEDICAL COMMITTEE

PRESIDENT Roosevelt has appointed Dr. George Baehr, Chief Medical Officer of the Office of Civilian Defense, to be a member of the Health and Medical Comimttee of the Office of Defense Health and Welfare Services. Dr. Irvin Abell, Louisville, Ky., chairman of the Committee on Medical Preparedness of the American Medical Association, is chairman of the Health and Medical Committee, and other members are the Surgeon General of the U. S. Army, Major General James C. Magee; the Surgeon General of the U. S. Navy, Rear Admiral Ross T. McIntire; the Surgeon General of the U. S. Public Health Service, Dr. Thomas Parran, and the chairman of the Division of Medical Sciences, National Research Council, Dr. Lewis W. Weed, Baltimore. The Office of Defense Health and Welfare Services is a part of the Office for Emergency Management which in turn is part of the Executive Office of the President. The director of the ODHWS is Paul V. McNutt, who is also Federal Security Administrator.

CHILD HEALTH DAY—1942

BY THE PRESIDENT OF THE UNITED STATES OF AMERICA

A PROCLAMATION

WHEREAS, the Congress by joint resolution of May 18, 1928 (45 Stat. 617), has authorized and requested the President of the United States to issue annually a proclamation setting apart May 1 as Child Health Day:

NOW, THEREFORE, I, FRANKLIN D. ROOSEVELT, President of the United States of America, in recognition of the vital importance of the health of children to the strength of the Nation, do hereby designate the first day of May of this year as Child Health Day.

And I call upon the people in each of our communities to contribute to the conservation of child health and the reduction of illness among children by exerting every effort to the end that before May Day, Child Health Day, children over nine months of age be immunized against diphtheria and smallpox, the two diseases for which we have the surest means of prevention.

IN WITNESS WHEREOF, I have hereunto set my hand and caused the seal of the United States of America to be affixed.

DONE at the City of Washington this sixth day of February in the year of our Lord nineteen hundred and forty-two and of the Independence of the United States of America the one hundred and sixty-sixth.

(SEAL) FRANKLIN D. ROOSEVELT

By the President:
CORDELL HULL
Secretary of State.

DENTAL HEALTH

THE National Dental Hygiene Association on February 1 brought out its first edition of a new quarterly magazine entitled *Dental Health*, devoted to the promotion of increased public participation in each community in dental health education and treatment programs and to news of dental health accomplishments in individual cities and towns.

The editorship of the magazine is in the hands of Randolph G. Bishop, Editor; Paul E. Morgan, Managing Editor; and Cullison Cady, Associate Editor. Editorial offices are Room 934, Shoreham Building, Washington, D. C. NOTE: Review copies of *Dental Health* will be mailed upon request.

TWELFTH NEW ENGLAND HEALTH INSTITUTE

EDWARD A. McLAUGHLIN, M.D., Executive Chairman, has announced the Twelfth New England Health Institute to be held in Providence at the Biltmore Hotel, April 21 to 23.

The New England Health Institute is held under the sponsorship of the State Departments of Health of Maine, Vermont, New Hampshire, Connecticut, Massachusetts, and Rhode Island. The Sponsoring Committee consists of Edward A. McLaughlin, M.D., *Chairman*, Roscoe L. Mitchell, M.D., Charles F. Dalton, M.D., Travis P. Burroughs, M.D., Stanley H. Osborn, M.D., and Paul J. Jackmauh, M.D. Further information can be obtained from the Institute at 317 State Office Building, Providence, R. I.

NEW GRADUATE COURSE IN INDUSTRIAL HYGIENE AND MEDICINE

FRED J. WAMPLER, M.D., Professor of Preventive Medicine in the Medical College of Virginia, Richmond, has announced a graduate course in industrial hygiene and medicine covering one, two, or three months' duration.

The course will be offered by the Medical College of Virginia in coöperation with the Bureau of Industrial Hygiene of the Virginia State Health Department, the Industrial Commission of Virginia, the State Department of Education, and the medical departments of several industries in and around Richmond.

The course will cover field experience in the medical departments of two or more industries, work with the State Health Department Bureau of Industrial Hygiene in a survey of an industrial plant and in a laboratory, time with the Industrial Commission in study of compensation setup and problems, time with the Division of Rehabilitation of the State Department of Education and lectures, seminars, discussions and assigned readings on compensation laws, casualty insurance, morbidity and mortality reporting, statistics of industrial employment, special disease control programs in industries, labor's attitude toward medical programs, and the position of the industrial nurse in the medical program.

The tuition for the course will be $50 for the first month, and $25 for each succeeding month. Instruction will begin at any time after arrangements with the college.

PERSONALS

Central States

HENRY H. ASHER, M.D.,† who for the past 2 years served as County Health Officer in Sedgwick County, Kans., has taken over the position of Director of the Division of Local Health Services with the Kansas State Board of Health at Topeka.

FRANK J. HILL, M.D.,† of Bismarck

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* Fellow A.P.H.A.
† Member A.P.H.A.

has been appointed acting State Health Officer of North Dakota, to succeed MAYSIL M. WILLIAMS, M.D., C.P.H.,* who has resigned to become District Health Officer in the New York City Department of Health.

B. RUSSELL FRANKLIN,† Sanitarian with the Ingham County Health Department in Michigan, has been appointed Chief Sanitarian of the Lorain County District Department of Health, Oberlin, Ohio.

HARRIET FULMER, R.N.,* resigned March 1 from the Rural Nursing Service of Cook County, Ill. Miss Fulmer, who at the time of her retirement was supervisor of nurses in the Public Health Unit, Chicago, has completed 25 years in this position.

THEODORE G. KLUMPP, recently appointed Secretary of the Council on Pharmacy and Chemistry of the American Medical Association, Chicago, has resigned to become President of the Winthrop Chemical Company, Inc., New York, N. Y.

ARTHUR B. REAM, M.D., of Mechanicsburg, Ohio, has been appointed Health Commissioner of Clermont County.

GEORGE M. SHINERS, M.D., Green Bay, Wis., has been appointed Health Commissioner of Green Bay.

WILLIAM E. SOVIK, M.D., has been appointed Health Officer of Campbell. Ohio, succeeding DR. EDWARD J. REILLY.

JOHN W. TURNER, M.D.,† formerly Health Officer of Marion County, Kans., has been appointed Health Officer of Sedgwick County, succeeding DR. HENRY H. ASHER.†

Eastern States

THOMAS J. BERGIN, M.D.,† Cos Cob, Conn., has been appointed full-time Health Officer of the town of Greenwich.

ALBERT E. CHILDS, M.D., of Litchfield, Conn., has succeeded ELTON R. SKILTON, as Health Officer of Morris.

L. A. MACLEAN, M.D., D.P.H., recently of Massachusetts, has been appointed County Health Officer of Monongalia County, W. Va., and Director of the West Virginia Public Health Training Center at Morgantown. He succeeds DR. E. G. MCGAVRAN, now the Health Officer of St. Louis County, Clayton, Mo.

HUBLEY R. OWEN, M.D.,† Philadelphia, Pa., resigned as Chairman of the Council of Defense to give full time to his work as Director of Public Health.

ERNEST R. PENDLETON, M.D., has been appointed Health Officer of East Granby and Hartland, Conn., succeeding respectively, DR. ADOLPH VIETS, and DR. EDWARD A. GAYLORD.

PHILIP E. SCHWARTZ, M.D., has been appointed Health Officer of Portland, Conn., succeeding DR. JOHN R. TARRANT.

Southern States

BURTON F. AUSTIN, M.D.,† of Montgomery, Ala., Chief of the Bureau of Hygiene and Nursing of the State Department of Health, has been appointed Acting Health Officer of Alabama, pending a permanent selection to succeed the late JAMES N. BAKER, M.D., Montgomery.

RALPH L. BEST, M.D., Drumright, Okla., has been made Health Officer of Green County, with headquarters in Eutaw.

THOMAS O. COPPEDGE, M.D.,† Nashville, N. C., is now Health Officer of Nash County.

JESSE M. DISHMAN, M.D.,† of Princeton, Ky., Health Officer of Caldwell County, has been appointed Health Officer of Fulton County, succeeding LAYSON B. SWANN, M.D., of Paducah, who resigned to enter the army.

FREDERICK EBERSON, M.D., Ph.D.,*

formerly Pathologist and Director of Laboratories, Gallinger Hospital, Washington, D. C., has been appointed Medical and Research Director, National Drug Company, Philadelphia, Pa.

CORINNE S. EDDY, M.D.,† Centerville, Ala., has been appointed Health Officer for Bibb County. Dr. Eddy was formerly connected with the unit in Cleburne County.

FRANK L. LAPSLEY, M.D., Shelbyville, Ky., has been reëlected Health Officer of Shelby County for a four year term.

LEO B. SKEEN, M.D., Sanatorium, N. C., has been named Health Officer of Iredell County.

VERNON W. TAYLOR, JR., M.D., of Madison, N. C., has been appointed Assistant Medical Director of the city hospital system of Winston-Salem, a position recently created because of an expanded program of public service.

WARREN T. VAUGHAN, M.D., of Richmond, Va., was awarded the honorary degree of Master of Science by the University of Michigan, Ann Arbor.

CLIFFORD E. WALLER, M.D.,* Silver Springs, Md., formerly Medical Director, U. S. Public Health Service, has been appointed Health Officer of the newly organized Health Department in Loudoun County, Leesburg, Va.

Western States

HARRY J. ANDERSON, M.D., of Corvallis, Ore., has been named Health Officer of Benton County, succeeding DR. WILLIAM T. JOHNSON, who held the position for many years.

AMOS CHRISTIE, M.D.,† has been appointed Assistant Director of Medical and Health Service for the American Red Cross as announced by National Headquarters. Dr. Christie, who is a member of the California State Board of Health, has been Associate Professor of Pediatrics at the University of California, San Francisco, from which institution he received his M.D. degree in 1929. He will be associated with ALBERT MCCOWN, M.D., Dr.P.H.,* Director of Medical and Health Service.

CLARENCE R. E. LINDGREN, M.D., of Eugene, Ore., has been appointed Health Officer of Lane County.

EMIL E. PALMQUIST, M.D.,† Colfax, Wash., Health Officer of Whitman County, has been granted 6 months' leave of absence to study health administration at the University of Michigan, Ann Arbor. During his absence DR. PHILIP J. HOLABACH, Colfax, will be Health Officer.

JEAN G. ROBERTS, R.N., has been appointed Pacific Coast Nursing Supervisor of the Metropolitan Life Insurance Company Pacific Coast Head Office, San Francisco, succeeding Helen LaMalle who has retired. Mrs. Roberts has been Territorial Supervisor with the Metropolitan for the past two years.

RUSSELL H. WILSON, M.D., of Bremerton, Wash., has been appointed in charge of the Kitsap County Health Department, succeeding DR. HARALD M. GRANING, who was assigned to the Plague Laboratory of the U. S. Public Health Service at San Francisco.

Canada

G. W. MILLER, M.D., D.P.H., has been appointed Principal Medical Officer of the Royal Navy in India and of the Royal Indian Navy. Dr. Miller is a graduate of the University of Toronto and received his diploma in public health in 1936. He was formerly Deputy Public Health Commissioner with the government of India.

DEATHS

ALBERT E. AUSTIN, M.D., former Health Officer for 20 years of Greenwich, Conn., died on January 26 at the age of 64. He was President of the Old Greenwich Trust Company, a practising physician, and from 1939 to 1941 was Representative from the 4th Connecticut District in Congress.

H. C. BROWN, M.D., Health Officer of the City of San Jose, Calif., died on December 30, 1941.

SAMUEL W. LAMBERT, M.D., Dean of the College of Physicians and Surgeons of Columbia University, New York, N. Y., 1904–1919, and a former President of the New York Academy of Medicine, died on February 10.

PROFESSOR MERRILL J. MACK, Dairy Industry Specialist of Massachusetts State College, Amherst, died on February 9 following an operation, at the age of 39. Dr. Mack became a member of the Association in 1928 and a Fellow in 1933. He was identified with the Food and Nutrition Section.

CONFERENCES AND DATES

American Academy of Pediatrics—Region I. Hotel Bellevue-Stratford, Philadelphia, Pa. April 1–3.

American Academy of Political & Social Science. Philadelphia, Pa. April 10–11.

American Association for Social Security. New York, N. Y. April 10–11.

American Association for the Advancement of Science. Ann Arbor, Mich. June 22–25.

American Association of Industrial Physicians and Surgeons, and the American Industrial Hygiene Association—Joint Annual Convention. Gibson Hotel, Cincinnati, Ohio. April 13–17.

American Association of Orthodontists. New Orleans, La. March 16–19.

American Association of Social Workers—Delegate Conference. New Orleans, La. May.

American College of Physicians. Public Auditorium. St. Paul, Minn. April 20–24.

American Congress on Obstetrics and Gynecology—Municipal Auditorium, St. Louis, Mo. April 6–10.

American Home Economics Association. Boston, Mass. June 21–25.

American Library Association. Milwaukee, Wis. June 21–27.

American Medical Association. Convention Hall, Atlantic City, N. J. June 8–12.

American Psychiatric Association. Hotel Statler, Boston, Mass. May 18–22.

American Public Health Association—71st Annual Meeting. Headquarters, Municipal Auditorium, St. Louis, Mo. October 27–30.

American Society of Civil Engineers—Spring Meeting, New Orleans, La. April. Summer Meeting, Spokane, Wash. July.

American Society of Planning Officials—Joint Conference with National Conference on Planning. Indianapolis, Ind. May 24–28 (tentative).

American Water Works Association—
Indiana Section—Purdue Memorial Building, Lafayette, Ind. April 9–10.
Canadian Section—General Brock Hotel, Niagara Falls, Ontario, Canada, April 15–17.
Southeastern Section. Savannah, Ga. April 20–22.
New York Section. Niagara Falls, N. Y. April 30–May 1.
Pacific Northwest Section—Marcus Whitman Hotel, Walla Walla, Wash. May 7–9.
Ohio Section. Toledo, Ohio. May 15–16.
Annual Convention—The Stevens Hotel, Chicago, Ill. June 21–25.

Greater New York Safety Council, Inc.—Thirteenth Safety Convention and Exposition. Hotel Pennsylvania, New York, N. Y. March 3–6.

Institute of Food Technologists. Minneapolis, Minn. June 15–17.

Michigan Public Health Association. Grand Rapids, Mich. November 11–13.

Missouri Public Health Association. Kansas City, Mo. May 7–9.

National Association of County Officials. Hollywood, Calif. May 20–23.

National Association of Housing Officials. Los Angeles, Calif. June 10–13.

National Conference of Social Work. New Orleans, La. May 10–16.

National Council of State and Local Public Welfare Administrators. May.

National Education Association. Denver, Colo. June 28–July 2.

National Gastroenterological Association. Biltmore Hotel, New York, N. Y. June 3–6.

National Organization for Public Health Nursing. Biennial Convention. Palmer House, Stevens Hotel and The Coliseum, Chicago, Ill. May 18–22.

National Tuberculosis Association—38th An-